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PESTICIDES ABSTRACTS (formerly Health Aspects of Pesticides Abstract Bulletin) is a monthly publication of the Technical Services Division of the Office of Pesticide Programs, Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides as defined in the Table of Contents. The publication represents a monthly review of more than 2,000 primary and secondary sources. A list of periodicals from which articles have been abstracted appears annually in the January issue. Subjects and authors of abstracted articles are cross-referenced in quarterly and annual indexes. Reprint requests should be directed to the author of the complete article.

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76-0586. Donaubauer, E. (Author address not given). **Forstschutz zwischen Wirtschaft und Umweltschutz. [Forest protection, economic and environmental aspects.]** *Allg. Forstz.* 85(9): 240-242; 1974. (German)

General problems of sylvan ecosystems and forest damages due to anthropogenic and spontaneous factors are reviewed. Experiments are being conducted with polyhedron virus, *Bacillus thuringiensis*, attractants, and juvenile hormones as potential means of pest control in forests. Since, however, biological pest control is not expected to ever replace chemical pesticides completely, the development of pesticides with increased efficiency and reduced environmental hazards will require great efforts.

76-0587. Russell, C. S. (Resources for the Future, Inc., Washington, DC 20036). **Environment and development.** *Biol. Conserv.* 7(3): 227-234; 1975. (6 references)

Environmental vs. developmental issues are coming more to the forefront of world attention as the developing countries attempt to grow. In this paper an attempt is made to: separate issues so as to clarify the argument; dispel one or two persistent myths; suggest where quantitative analysis may be of help; and speculate on rudimentary institutional forms which may provide the basis for the first positive steps in resolving this problem. From reviewing the various issues involved it was concluded that development must not and probably could not be stopped. The major nations of the world should not attempt to make the political decisions for developing nations on the appropriate balance between their own environmental quality and material goods production. The fact that there are real environmental costs, not just aesthetic losses, associated with uncontrolled growth, urbanization and industrialization should be emphasized. When developmental loans and grants are awarded, the recipients should be helped to view a range of choices in attaining desired goals. Predictable environmental damages should be described. In cases of true global pollution, such as persistent pesticides, where everyone stands to suffer, it seems equitable that the rich countries incur most of the costs for whatever controls or limits are adopted now as they caused most of this particular problem. It is also urged that a formal and reasonably efficient mechanism be established for transferring income from richer to poorer specifically to pay for the preservation of endangered species, habitats, and natural landscapes.

76-0588. Magos, L. (Med. Res. Council, Toxicol. Unit, Carshalton, Surrey, England). **Mercury and mercurials.** *Br. Med. Bull.* 31(3): 241-245; 1975. (48 references)

During the last decade, about 20,000 tons of mercury have been released yearly into the environment. Although mercury does not tend to accumulate in the terrestrial food chain, it accumulates against a steep concentration gradient in the aquatic food chain. Mercury in its different forms represents different types of hazard with different toxicities. For example, exposure to metallic mercury, generally mercury vapor, is nearly always occupational, while exposure to inorganic mercury salts may result from food consumption and the use of mercury as a moss killer at harvest time. Human beings can be exposed to the phenyl- and methoxyethyl- mercury salts used as fungicides during production and while grain is being dressed, or by eating dressed grain. These organomercurial dressing powders can produce contact dermatitis or a profound and extensive skin reaction not restricted to the contaminated area. The proposed threshold limit for occupational exposure to these compounds is 0.1 mg mercury/m^3 air. Methylmercury is also used as a seed dressing and once bound to seeds is very difficult to remove. It easily penetrates the placenta, is secreted in mother's milk, and its absorption from the gastrointestinal tract is about 95%. Methylmercury intoxication is characterized by ataxia, dysarthria, and constriction of the visual field. Clearance of mercury from the blood can be accelerated by D-penicillamine, *N*-acetyl-DL-penicillamine, or nonabsorbable thiol resin and treatment should be begun before the onset of clinical manifestations. The blood levels of methylmercury associated with the appearance of toxic effects vary, but a tolerable daily uptake level of 0.5 μg/kg has been suggested by the Joint FAO/WHO Expert Committee on Food Additives.

76-0589. Higginson, J. (Centre Internatl. Rech. Cancer, Lyon, France). **Programme du Centre International de Recherche sur le Cancer: Approche epidemiologique. [Program of the International Center for Cancer Research: epidemiological approach.]** *Bull. Cancer* 62(2): 137-150; 1975. (French)

The epidemiological program of the International Center for Cancer Research is outlined. New chemical substances introduced in industry and agriculture require preliminary animal tests for toxicity and carcinogenicity. However, negative findings obtained for animals do not necessarily imply the absence of carcinogenic properties in humans, and there may be substances that are carcinogenic in humans but not in animals. The role of pesticide residues in carcinogenesis has been the subject of public scrutiny recently.

76-0590. Anonymous. **Let the beasties beware.** *Environ. Sci. Technol.* 9(10): 905; 1975.

At a recent conference on "Human Health Effects of New Approaches to Insect Pest Control", sponsored by the NIEHS and EPA, chemical and biological alternatives to hazardous chemical pesticides were discussed. Some of the alternative chemicals considered were pyrethroids, organotin compounds and formamidines, chemosterilants, juvenile hormones and insect growth regulators, pheromones, and entomopathogens. Robert van den Bosch argued that the increased use of biological controls would decrease the need for chemical pesticides and the concomitant environmental damage. Biological control is safe and, from a public health standpoint, prevents human

starvation, controls disease vectors, and eliminates the need for massive chemical pesticide use. When biological control becomes a component of an integrated pest management (IPM) program, it can break the present cycle of pesticide use. IPM represents an attempt to utilize a variety of technologies in an economically and ecologically sound fashion while simultaneously maximizing crop yield. IPM requires highly trained agromedical personnel, systems analysis, and computer modeling. An unresolved problem remains the unwillingness of the pesticide industry to invest large sums of developmental money in the nonpatentable newer chemical products.

76-0591. Izzotti, S. (Ist. d'Igiene dell'Univ. di Genova, Genoa, Italy). **Il servizio fitosanitario e micologico nel Comune di Genova.** [**Mycological and phytosanitarian services in Genoa.**] *G. Ig. Med. Prev.* 14(1-2): 105-131; 1973. (36 references) (Italian)

The structure and function of the Genoan mycological and phytosanitarian services are examined. Emphasis is placed on their important role in the hygienic and sanitary control of fruits and vegetables in establishing minimum requirement qualifications for most common products and in evaluating the amount of residues of pesticides which could be harmful to the human organism. The Laboratorio Provinciale d'Igiene e Profilassi is in charge of most of the sample studies for which it employs microscopic, chemical, and micrographic analytical methods. A list is presented of tolerable amounts of some pesticide residues in fruits and vegetables, and the minimum qualitative requirements of major fruits and vegetables are described.

76-0592. De Blasi, R. (Ist. di Igiene, Univ. di Messina, Messina, Italy). **L'inquinamento del suolo e la catena alimentare.** [**Soil pollution and the food chain.**] *Ig. Mod.* 67(5): 571-580; 1974. (17 references) (Italian)

Pesticides, along with chemical fertilizers, are the main source of chemical soil pollution. They comprise insecticides, fungicides, and any other agent used not only to control pathogenic vectors but to rid agricultural products of damaging organisms. Organophosphorus insecticides produce acute intoxication symptoms, whereas organochlorine insecticides can create chronic intoxication because of their chemical stability and their capacity for bioconcentration and accumulation. A number of the latter can remain active on the soil for many years and unaffected by the filtering action of the soil. Their persistence within the soil will vary according to the type of soil, the type of vegetation, the temperature, and the amount of humidity. Such contamination of the soil spreads to many plants and their products. The persistence of organochlorine insecticides in plants is extremely great. Through the consumption of vegatation or food products contaminated by organochlorine insecticides, a number of domestic animals are contaminated, and so are their products such as milk and eggs. Cooking and various preparation methods rarely remove or neutralize the insecticides. It has been estimated that man ingests 0.184 mg of DDT a day with his food.

76-0593. Smith, A. E.; Secoy, D. M. (Agric. Canada, Regina Res. Stn., Regina, Saskatchewan, Canada). **Forerunners of pesticides in classical Greece and Rome.** *J. Agric. Food Chem.* 23(6): 1050-1055; 1975.

Various methods for pest control described by the classical writers are discussed. These include religion, folk magic, and the use of what may be termed chemical methods for the control of plant diseases, weeds, and insect and animal pests. These last are described in some detail and attempts are made to assess their possible success. Although the efficacy of such methods may be open to conjecture, the principles of seed treatment, fumigation, tree banding, and the use of preparations to control pests appear to have been widely used. (Author abstract by permission)

76-0594. Papworth, D. S.; Taylor, J. K. (Pest Infestation Control Lab., Ministry Agric., Fish., Food, England). **Survey of pesticides used in flour mills.** *J. Flour Anim. Food Milling* 157(6): 21-22; 1975.

Pesticide use by the 119 flour mills operating in the United Kingdom in December 1972 was surveyed. The data was compared with that obtained from 66 mills in 1965/66. The following pesticides were used by at least one mill in 1965/66: DDT, γ-BHC, dichlorvos, malathion, pyrethrins, carbon tetrachloride, ethylene dibromide, ethylene dichloride, hydrogen cyanide, methyl bromide, α-chloralose, thallium sulfate, warfarin, and zinc phosphide. In addition to these, fenitrothion, arsenious oxide, and coumatetralyl were used in 1972. Very small quantities of dieldrin, propoxur, nicotine, norbormide, sodium cyanide, and chlordecone were also used by some mills. Insect infestation in flour mills is currently lower than in some periods in the past; improved storage, hygiene, and transport as well as pesticides have contributed to this. Dichlorvos use increased in 1972 compared with 1965/66, while the use of γ-BHC and malathion decreased. In addition, the mills have shown an increased use of servicing companies for pest control. The survey indicates that pesticide usage in flour mills is very small and that any contribution to pesticide residues in man is negligible.

76-0595. Zimmermann, G. (Biol. Bundesanst., Inst. Biol. Schaedlingsbekaempf., Darmstadt, Germany). **Ueber die Wirkung systemischer Fungizide auf verschiedene insektenpathogene *Fungi imperfecti* in vitro.** [**Effect of systemic fungicides on different entomopathogenic *Fungi imperfecti* in vitro.**] *Nachrichtenbl. Dtsch. Pflanzenschutzd. (Braunschweig)* 27(8): 113-117; 1975. (14 references) (German)

The in vitro effect of the seven systemic fungicides calixin (tridemorph), cercobin M (Thiophanate-methyl),

benomyl, imugan (chloraniformethane), milstem (ethirimol), plantvax (oxycarboxin), and saprol (triforine) on five entomopathogenic fungi (*Beauveria bassiana, B. tenella, Metarrhizium anisopliae, Paecillomyces farinosus, P. fumoso-roseus*) is reported. Benomyl and saprol greatly suppressed spore germination in nearly all species. Calixin had a similar effect on the growth of mycelium. Plantvax and milstem showed the lowest noxious effects. In all fungi tested, cercobin M was better tolerated than benomyl, a related compound. The effect of fungicides, in most cases, on spore germination was very distinct from that on growth, which revealed a much more sensitive reaction.

76-0596. Anonymous. **EPA on trial: is Agency's punitive mentality the will of Congress?** *Pest Contr.* 43(8): 10-11, 27; 1975.

Excerpts from testimony by the National Pest Control Association before the House Agriculture Committee on May 16, 1975 are presented to outline the major responses of the structural pest control industry toward implementation of the Federal Pesticide Law by the EPA. It is felt that Agency implementation is out of phase with Congressional intent in many ways and is inconsistent with the overall needs of the country. It is recommended that the Agency's budget for pesticides (roughly $49 million) be reallocated from its proposed form to one which would accomplish the registration/reregistration of restricted and general use pesticides and the certification of private and commercial applicators. It is also recommended that enforcement and legal matters be deemphasized to allow the Agency to concentrate on its major tasks. The Agency's authority to expend funds should be limited to 50% of its authorization until it is determined that it has complied with Congressional directions.

76-0597. Metzger, H.; Strohbusch, D. F. (Plant Protect. Div., BASF Aktiengesellschaft, Germany). **Development of a new pesticide.** *Pesticides* 8(7): 33-38; 1974.

To fulfill the task of providing an adequate food supply for all of mankind, more and more effective pesticides with target application capability must be developed by the chemical industry. Currently, there are only 30-35 research centers for the development of pesticides throughout the world and this number may be reduced in the future due to drastically increasing costs. At least 6.9 yr are required for the development of a new pesticide from its initial synthesis until it becomes a possibly marketable product. Each year 6,000-8,000 substances are tested in the BASF laboratories. These substances are subjected to a number of screening tests to determine whether they offer any possible plant protective action; the screening tests are conducted first in the greenhouse and then in the field. Then trials lasting 1-2 yr are conducted in accordance with the tentative instructions for usage and suitable formulation methods are devised. The possible toxicological effects and the influence of the new compound on the environment must also be clarified. Finally, a pesticide can be sold only if it has been approved by and registered with the responsible governmental control authorities in a given country.

76-0598. Apgar, W. (Pennsylvania Dep. Environ. Resour., Harrisburg, PA). **A review of pesticide usage in Pennsylvania agriculture.** *Pesticides Project, Bureau of Community Environmental Control,* Harrisburg, PA, 1975, 27p.

A statistical analysis was made of pesticide usage on Pennsylvania farmlands. A total of 774 farms were contacted, or about 1.1% of the total 73,000 farms in the state, and covering .9% of the total farm acreage. During 1973, pesticides were applied to 82% of the farms contacted. Large farms used pesticides more frequently in their operations than did small farms. A total of 61 different pesticides were used including 34 insecticides, 16 herbicides, 5 fungicides, 4 miticides, 1 plant growth regulator, and 1 fumigant. About 80% of the farms used herbicides, about 40% used insecticides. On most of the farms, the chemicals were applied by the farmer and/or his employees without outside assistance. Highly toxic pesticides are currently being used on 13% of the state's farms; of the 13, 8 are anticholinesterase agents. Farmers who applied highly toxic pesticides frequently failed to employ recommended safety measures. About 13% of the state's farms had persistent pesticides used on them during 1973. All but one of the 9 persistent chemicals employed were chlorinated hydrocarbon insecticides. Only 7% of the storage areas observed were under lock and key. Burning was by far the most commonly used method for the disposal of bags and other burnable containers. Nonflammable waste containers were most frequently disposed of by burial on the farm premises.

76-0599. Smelt, J. H.; Leistra, M. (Lab. Res. Insect., Wageningen, The Netherlands). **Hexachlorobenzene in soils and crops after soil treatment with pentachloronitrobenzene.** *Agric. Environ.* 1(1): 65-71; 1974. (2 references)

A survey was made of the concentrations of hexachlorobenzene in soils and the extent to which this compound is taken up by various crops. Soil and crop samples were taken in different periods of harvesting, (June-September 1973). Soil content averaged 0.11 mg/kg (hexachlorobenzene); 0.12 mg/kg (pentachlorobenzene); and 0.61 mg/kg (pentachloronitrobenzene). The expected increase in hexachlorobenzene content in soil with an application of 20 kg/ha pentachloronitrobenzene is 0.15 mg/kg if the pentachloronitrobenzene contains 3% hexachlorobenzene. At 135 kg/ha seed dusted with 2 g fungicide mixture (containing 0.13 g hexachlorobenzene/g) per kg seed, the increase in hexachlorobenzene content in the soil system studied was 0.009 mg/kg. In most crop samples examined, hexachlorobenzene was found in measurable quantities. The lowest crop to soil ratios were found for sugar-beet crown, sugar-beet leaves, and the upper part of grass blades. In nearly all instances with potato tubers, tulip bulbs, and shallots, the crop to soil ratios were distinctly less than one. The lower part of grass blades, carrot leaves, and turnip roots show some accumulation, but the highest accumulation was in grass roots and carrots. Most crops showed a distinct decrease in hexachlorobenzene content from the roots to the top of the plant. Sugar beets at harvest were an exception. Crop age and growth stage are important when predicting uptake of hexachlorobenzene from the soil. With potatoes, the level of hexachlorobenzene in the peel was about 5 times that in the rest of the tubers. Fodder available from contaminated and uncontaminated fields can be used to estimate whether the daily intake by cattle is within the prescribed tolerances. As these residues restrict the utility of the crops, hexachlorobenzene should be substantially reduced in formulations of pentachloronitrobenzene.

76-0600. Van Wambeke, E. (Lab. Phytopathol., Katholieke Univ. Leuven, Heverlee, Belgium). **Bromide residues in lettuce after soil fumigation with methyl bromide, and some factors involved.** *Agric. Environ.* 1(3): 277-282; 1974. (10 references)

Because different residue tolerances for bromide have been proposed by different countries and organizations a study was made of factors which affect the bromide content of vegetables after soil fumigation with methyl bromide. Lettuce plants were studied because of their problematic accumulation of bromide. High residue levels in agricultural crops have been detected by several independent researchers. The optimum soil conditions for maximum fumigation efficacy are low organic matter content, low adsorptive capacity for fumigants, low continuous air space and low water content. These conditions are also favorable for low bromide residue levels. Leaching decreases bromide residues, but damages soil texture. High organic matter content in the soil gives a high sorption of bromide and is disadvantageous for effective disinfection. Intervals between fumigation, planting, and harvesting affect the bromide content of plants, particularly in mineral soils. Methyl bromide dosage does not affect the bromide residue level after a long fumigation period at high temperatures due to the equilibrium of fumigant in the substrate. A higher dosage of methyl bromide applied at a low temperature for a short period may be more favorable for low bromide content than a lower dosage applied at a higher temperature for a longer period. The results indicate the possibility of decreasing the bromide content of plants by controlling fumigation conditions in relation to dosage and time intervals between fumigation and planting.

76-0601. Gollop, Z. (Dead Sea Bromine Co., Ltd., Beersheba, Israel). **The problems of bromine residues after soil fumigation.** *Agric. Environ.* 1(3): 317-320; 1974.

There have been discrepancies in values reported for residues of inorganic bromine in vegetable crops following soil fumigation with methyl bromide, especially in the first year following such fumigation. Some reasons for these differences are discussed. First, some tests have been conducted on non-irrigated plots, while all other known tests were done either in glasshouses or in those countries where all crops are fully irrigated. Second, a variety of methods have been used for the determination of bromine residues in various countries. It is suggested that a recognized standard of measurement be established. Third, the different methods of analysis show the values of the residues in dry matter, in fresh substances or in both, which often makes comparisons impossible. Fourth, bromine ions are found in varying concentrations in different parts of a plant; such parts must be specified if comparisons are to have meaning. These findings suggest that, as the bromine residues are generally very low in tomatoes, cucumbers, eggplants, melons and strawberries, these crops can be grown with no danger almost immediately following fumigation with methyl bromide, especially in sandy and loamy soils in which the bromine fixation is very slight. Clay soil and soils rich in organic matter where bromine ions are easily fixed should be washed thoroughly. Crops such as lettuce, spinach, cabbage, etc., where the green parts of the plant are consumed, should never be grown as first crops following methyl bromide fumigation, but as second crops. Such fumigation is helpful for these crops, however, when they are grown following tomatoes and cucumbers. To effectively reduce the bromine residues in soils, the following factors must be considered important: soil preparation should be as deep as possible and when ploughing, care must be taken not to create a hard pan which could decrease soil permeability. Soil moisture should not be greater than 65% of field capacity at the time of fumigation, otherwise washing becomes impossible; and washing of the soil should start 48 hr after the start of aeration. A minimum 200 mm of water proved to be effective, but it is

noted that the concentration of irrigation is most important. If the 200 mm are divided into a number of irrigations, or if they are spread out over a week, for example, leaching will be incomplete.

76-0602. Hoffman, G. M.; Malkomes, H. P. (Tech. Univ. Munich, Inst. Phytopathol., Freising, West Germany). **Bromide residues in vegetable crops after soil fumigation with methyl bromide.** *Agric. Environ.* 1(3): 321-328; 1974.

Problems have arisen in connection with the bromide residues remaining in soils after fumigation with methyl bromide. The hydrogen bromide formed on destruction of methyl bromide in water and under soil conditions is taken up by plants in the dissociation form. Under natural conditions, the Br content of soil has a level of about 1-5 ppm. Higher levels of 800 ppm exist, especially in Japanese volcanic soils. During soil treatment with bromine-containing pesticides, the supply of bromine reaches a level of 170 kg/ha with EDB, 60 kg/ha with DBCP, and 400-560 kg/ha with methyl bromide. The bromide level in the soil can vary from 3-50 ppm. The bromide salts are initially bound loosely in the soil complex and can thus be used by the plants. A level of 100 ppm Br and more can be reached in plant matter depending on the species, plant organs, general growth and soil conditions, the method of application, and the amount of methyl bromide used. Foliage vegetables have been found to contain the highest concentrations. The uptake of Br can be reduced by soil irrigation immediately after treatment. During harvest, the Br content in cucumber and tomato fruits slowly decreases.

76-0603. Ladonin, V. F.; Tsimbalist, N. I. (All-Union Sci. Res. Inst. Fertilization and Soil Sci., Moscow, USSR). **Dinamika soderzhaniya atrazina v promyvnykh vodakh v zavisimosti ot doz gerbitsida i urovney mineral'nogo pitaniya na fone izvesti. [Atrazine residue dynamics in percolating water as a function of the dose of herbicide and lime-base fertilizers.]** *Agrokhimiya* 8 : 111-115; 1975. (24 references) (Russian)

The leaching of atrazine from limed soil containing 1.79% humus was studied as a function of the pesticide dose and of the nitrogen-potassium-phosphorus fertilizer dose in laboratory experiments. The atrazine doses were 2, 4, and 8 kg/ha. The leaching increased with increased atrazine dosage and with decreased fertilizer dosage. The leaching was highest in soils without fertilizer. Corn plants also reduced the leaching, especially in soils with small fertilizer doses. The findings indicate that inorganic fertilization has no considerable influence on the leaching of *s*-triazines when the latter are used in optimal doses under field conditions.

76-0604. Wolfe, H. R.; Armstrong, J. F.; Staiff, D. C.; Comer, S. W.; Durham, W. F. (U. S. Environ. Protect. Ag., Natl. Environ. Res. Cent., Pesticides and Toxic Substances Effects Lab., Field Studies Sect., Wenatchee, WA 98801). **Exposure of apple thinners to parathion residues.** *Arch. Environ. Contam. Toxicol.* 3(3): 257-267; 1975. (10 references)

In studies of potential exposure of a volunteer working under controlled conditions during apple hand-thinning operations at 1, 24, 48, 72, 96, 168, and 240 hr after application of conventional 0.03% parathion spray, both dermal and respiratory exposure values were greater where water-wettable powder formulations were used than where emulsifiables were used. Residue levels of parathion on leaves from the two types of applications were about the same. Only trace amounts of paraoxon could be detected at one and seven days after application. Highest exposure values (14.2 mg/hr dermally and 0.15 mg/hr respiratorily) were obtained within 25 hr of application. Exposure was considerably less after residues were 72 hr old. Greatest exposure was on the forearms and hands. Urinary *p*-nitrophenol excretion indicated slightly more absorption following exposure in water-wettable powder experimental plots. Potential exposure values indicate that absorption could reach hazardous levels after one or two hr of work, even at the 96-hr residue period, if all the pesticide were absorbed. Considering that only a small fraction of the total amount would be absorbed, it is calculated that a 72-hr residue period poisoning should not occur. There was no significant change in blood cholinesterase activity of the volunteer worker. Variation in spray deposit within an orchard due to poor tank mixing did not appear to be great enough to be considered an important factor affecting exposure. (Author abstract by permission)

76-0605. Ware, G. W.; Morgan, D. P.; Estesen, B. J.; Cahill, W. P. (Dep. Entomol., Univ. Arizona, Tucson, AZ 85721). **Establishment of reentry intervals for organophosphate-treated cotton fields based on human data: III. 12 to 72 hours post-treatment exposure to monocrotophos, ethyl- and methyl parathion.** *Arch. Environ. Contam. Toxicol.* 3(3): 289-306; 1975. (14 references)

Five human volunteers entered methyl parathion, ethyl parathion, or monocrotophos treated cotton fields for five-hr exposure periods when the residues of the respective pesticides had aged 12 hr, 24 and 48 hr, and 48 and 72 hr. Foliage residues of methyl parathion disappeared fastest, those of monocrotophos slowest. Personal exposure to pesticide was evaluated from contamination of skin, clothing, and ambient air, while actual absorption of chemical was assessed from pesticide concentration in blood, urinary metabolite excretion, and effects on blood cholinesterase activities. There are good correspondences between magnitudes of foliar residue, estimates of personal contamination, and measures of chemical absorption. Field exposures caused no symptoms or clinical signs of organophosphate poisoning and depressed averaged blood cholinesterase activities by no more than 14% of pre-exposure levels. (Author abstract by permission)

76-0606. Burns, J. E.; Parker, R. D. (Inst. Environ. Med., N. Y. Univ. Med. Cent., New York, NY 10016). **An investigation of the safety of cotton reentry for organophosphate application.** *Arch. Environ. Contam. Toxicol.* 3(3): 344-351; 1975.

Twelve cotton insects scouts were monitored during an entire pesticide application season by weekly determinations of *para*-nitrophenol excretion and biweekly cholinesterase measurements. These data were compared to weekly reentry intervals and pesticide application rates to study the validity of a 48-hr minimum reentry interval for methyl parathion-treated cotton. Methyl parathion represented 54.2% of the total amount of pesticide used with toxaphene 35.3%, ethyl parathion 4.1%, and other 6.4%. A significant decrease in erythrocyte and plasma cholinesterase was observed during initial exposure but during peak exposure the cholinesterase levels had returned to normal. The maximum mean amount of methyl and ethyl parathion absorbed by calculation from PNP excretion was 0.95 mg/24 hr (n = 12). Twelve percent of all reentries were within two days and during one week 48% occurred during the first two days after pesticide application. (Author abstract by permission)

76-0607. Hall, F. R.; Reichard, D. L.; Krueger, H. R. (Dep. Entomol., Ohio Agric. Res. Dev. Cent., Wooster, OH 44691). **Dislodgeable azinphosmethyl residues from air blast spraying of apple foliage in Ohio.** *Arch. Environ. Contam. Toxicol.* 3(3): 352-363; 1975. (15 references)

The distribution and decay rates of dislodgeable residues of azinphosmethyl applied by two types of air blast sprayers on apple foliage in Ohio was investigated. Leaf discs were taken from nine sites located on the periphery of Cortland apple trees at five dates after spraying. The sprayer delivering the higher airflow rate, but lower velocity, deposited the pesticide much more uniformly over the trees and applied more in the top of the tree. The other sprayer deposited the greatest proportion of pesticide on the site nearest the sprayer. The residue decreased at all sites and ranged from 42 to near 100% decrease at 14 days after spraying. (Author abstract by permission)

76-0608. Anonymous. (Div. Irrigation Res., CSIRO, Griffith, New South Wales, Australia). **Herbicide residues in the soil.** *In: Aust. Commonw. Sci. Ind. Res. Organ. Annu. Rep.*, 1972, p. 19-20.

Atrazine is widely used to control weeds in maize and sorghum crops in the Murrumbidgee Irrigation Areas of New South Wales. Simazine and propazine, two closely related chemicals, are used on other crops. Patterns of land use have changed and brought the fear that atrazine may persist in the soil long enough to harm crops such as soya beans, rice, and vegetables following closely in rotation after maize or sorghum. Studies of factors affecting the rate of breakdown of atrazine in the soil have been investigated. Atrazine is lost more rapidly from soil than from soil-free solutions, and studies are underway to find the soil factors which accelerate its disappearance. Soil microbes are not likely involved. Possible factors include adsorption on clay particles or perhaps the action of catalysts such as iron oxides or humic acids. Even within a small area atrazine persistence can vary greatly. Persistence increases markedly at low temperatures. It is concluded that careful use of the herbicide is essential.

76-0609. Pellegrini, M. G.; Cocchigni, M. (Ist. Ig., Univ. Camerino, Italy). **Presenza di insetticidi nelle acque superficiali sottoposte a trattamento di potabilizzazione. [Presence of insecticides in treated shallow waters.]** *Boll. Soc. Ital. Biol. Sper.* 50(15): 1138-1142; 1974. (14 references) (Italian)

This study was established to determine if a water treatment plant using flocculation, filtration, and chlorination, and located on the Chienti, was effective in reducing the level of insecticides in water as it was in decreasing bacterial content and in oxidizing organic substances. Gas chromatographic quantitative and qualitative analyses were conducted on a number of samples taken from the river before and after the water had passed through the treatment plant. Upstream from the plant, all of the chlorinated insecticides studied (lindane, heptachlor, aldrin, heptachlor epoxide, *p,p*-DDE, dieldrin, *p,p*-DDD, and *p,p*-DDT) were found in the samples, even if in moderate quantities. The highest concentrations were found in July and October, probably because of the torrential rains. Following treatment, the insecticide level was lowered, but total elimination was not achieved, even in cases of moderate quantities.

76-0610. Gilbertson, M. (Can. Wildl. Serv., Canada). **Seasonal changes in organochlorine compounds and mercury in common terns of Hamilton Harbour, Ontario.** *Bull. Environ. Contam. Toxicol.* 12(6): 726-732; 1974. (8 references)

The total mercury and organochlorine residues in 32 eggs or newly hatched Common Tern chicks and in five adult Common Terns were determined. Based on a calendar system in which April 18, 1971 represented day 1, the eggs were collected between days 30 and 90 and the adults were collected between days 18 and 68. The samples were collected from colonies on two artificial islands in Hamilton Harbour, Ontario. Analysis of the eggs and newly hatched chicks indicated that the birds arrived from migration with a significant tissue PCB content but negligible tissue DDE levels. Subsequently they became contaminated at the breeding site with both DDE and PCB. The ratio of PCB to DDE decreased with time to approximately the ratio found in the fish in the vicinity of the colony. The birds may have metabolized PCBs. Analysis of the adult tissues confirmed the conclusion that the contamination was of local origin. There was a significant correlation between the mercury level in the adult breast tissue and the

season date. This correlation did not hold for the eggs. Again, the results indicated that the mercury was ingested primarily in the vicinity of the breeding colony.

76-0611. Miller, S. R. (Smithfield Exp. Farm, Res. Br., Agric. Canada, Trenton, Ontario, Canada). **Color, firmness, starch content, and persistence of 2-chloroethylphosphonic acid in McIntosh apples.** *Can. J. Plant Sci.* 55(4): 1001-1006; 1975. (15 references)

Ethephon plus 2,4,5-TP stimulated color development and fruit softening of McIntosh (*Malus sylvestris* Mill.) apples after 7-10 days. Most of the large differences in fruit pressure observed 10 or more days after treatment were lost after 2 or 3 mo storage at 1° C. Analysis for residual ethephon indicated that its breakdown in McIntosh applies occurred at the same rate at room temperature, on the tree, or in storage at 1°C. The rate of breakdown was rapid for the first 17 days but decreased to a much slower rate after 30 days. The lack of color response with ethephon and 2,4,5-TP in some seasons was attributed to factors other than a slow breakdown of ethephon in the fruit. (Author abstract by permission)

76-0612. Council Agric. Sci. Technol. (Iowa State Univ., Ames, IA 50010). **Chlordane and heptachlor.** *Counc. Agric. Sci. Technol. Rep. No. 47*, 1975, 71p. (151 references)

Chlordane and heptachlor, chlorinated hydrocarbon insecticides in the cyclodiene group, are relatively persistent in the environment, with half-lives in soil of about 1 and 0.8 yr, resp., when used at agricultural rates. Chlordane and heptachlor tend to remain near the site of application in soils. Very small amounts are leached downward in soil. In surface waters, chlordane and heptachlor are either nondetectable or present in traces up to mean values of 6 parts per trillion. The volatility of heptachlor exceeds that of chlordane, and volatilization is a major pathway of loss of these insecticides from soils. Heptachlor is absorbed by plants from soils, but concentrations in plant tissues are usually lower than 1 ppm. Animals may obtain residues from ingested food. There is little evidence of accumulation of heptachlor residues in food chains. Chlordane is similarly absorbed by plants from soils, but the concentrations in plants from this source are low. Evidence of concentration of chlordane in food chains is lacking. One extensive use of these compounds is the control of soil-inhabiting insects which attack corn and other field crops. The culture of ornamental plants, including flowers, shrubs, trees, and turf grass relies heavily on chlordane for pest control. The greatest need for chlordane in the home garden is to control onion maggots and other root-feeding insects on vegetables. No satisfactory replacement exists for chlordane as a residual chemical barrier around houses to repel insects. Heptachlor is the most toxic insecticide available for use against termites. The acute hazard from chlordane and heptachlor to vertebrates is very limited. There is no evidence of acute poisoning in livestock from the proper use of these chemicals, and the reports of substantial fish losses related to usage of these products are rare. Two cases of children drinking unknown quantities of concentrated chlordane have been reported. In both instances, the children were very sick, but they recovered without event. No human deaths have been attributed to heptachlor. The long-term threat to health on the basis of exposure to chlordane and heptachlor in the food supply is very small. There is no evidence that use of chlordane in the home and garden constitutes a significant hazard. At present, there is no known evidence that chlordane and heptachlor are carcinogenic in humans.

76-0613. Meemken, H. A. (Chem. Landes-Untersuchungsamt Nordrhein-Westfalen, Muenster, Germany). **Rueckstaende von Pestiziden in fetthaltigen Lebensmitteln unter besonderer Beruecksichtigung der tierischen und pflanzlichen Fette und Oele. [Pesticide residues in fat-containing foods with special consideration of animal and vegetable fats and oils.]** *Fette Seifen Anstrichm.* 77(8): 290-296; 1975. (7 references) (German)

Results of organochlorine pesticide residue analyses in fat-containing foods of animal and plant origin are presented and investigations on the effect of processing on the residue levels in vegetable and animal fats and oils are reported. Residue analyses in milk, dairy products, poultry, fish, beef, pork, internal organs of cattle and hogs, suet, lard, and crude vegetable oils and fats show that hexachlorobenzene, BHC, DDT and its metabolites DDE and DDE, small quantities of dieldrin and heptachlor epoxide, as well as PCBs are present in all foods of animal origin and vegetable fats and oils. The residue levels found in meat and internal organs are largely the same. While bleaching and deacidification caused practically no reduction in organochlorine pesticide residues in animal and vegetable oils and fats, hydrogenation and deodorization were highly effective.

76-0614. Gofmekler, V. A.; Safonova, L. A. (Vladivostok Med. Inst., USSR). **Gigiyenicheskoye znacheniye gerbitsida propanida kak zagryaznitelya atmosfernogo vozdukha pri primenenii ego na risovykh polyakh. [Hygienic significance of the herbicide propanil as an atmospheric pollutant in its use on rice fields.]** *Gig. Sanit.* 40(9): 17-19; 1975. (4 references) (Russian)

The concentration of propanil in the air around rice fields was measured after aerochemical treatment with this herbicide. Toxicological tests were performed to establish the maximum allowable concentration of propanil in the air. Aerochemical distribution caused considerable air pollution by propanil, with the highest concentrations measured at 200-400 m from the treated rice fields. The propanil concentrations in the air dropped to 8.3% of that measured on the day of application. The odor was perceptible up to 3 km. A sanitary protection zone of 5 km is recommended between propanil-treated rice fields and settlements. The odor threshold was established at 0.004

mg/m³. Propanil had no effect on the brain electrical activity in a subthreshold concentration of 0.002 mg/m³. Chronic experiments on albino rats revealed that propanil in 0.0017 mg/m³ concentration has no effect on the reflexes and on major biochemical parameters, while higher concentrations caused increased serum aspartate-aminotransferase (SGPT) and alanine-aminotransferase (SGOT) activity levels, increased serum catalase activity, and increased reticulocyte count in the blood. The maximum allowable single-time and daily average concentration of propanil in the air is recommended to be set at 0.002 mg/m³.

76-0615. Zholdakova, Z. I. (Author address not given). **Po povodu stat'i S. D. Zaugol'nikova, M. M. Kochanova, A. O. Loyta, I. I. Stavchenskogo "K voprosu o prognozirovanii opasnosti organicheskikh soedineniy vo vneshney srede". [Comments on article by S. D. Zaugol'nik, M. M. Kochanova, A. O. Loyt, and I. I. Stavchanskiy "On prediction of hazards of organic compounds in the environment."]** *Gig. Sanit.* 40(9): 92-94; 1975. (4 references) (Russian)

Critical comments are given on a paper dealing with the prediction of hazards of organic compounds in different environmental media. The solubility in water, proposed in that paper as a major criterion for the prediction of the environmental hazards of chemical compounds, is unacceptable, as the hazards are determined to a far greater degree by the stability, persistence and accumulation of the compounds in aquatic ecosystems. This implies that even practically insoluble compounds, such as DDT and other organochlorine pesticides, which are highly persistent and have pronounced cumulative properties, are more hazardous than highly toxic compounds which rapidly metabolize into non-toxic compounds. The hazards of pesticides in water may be greatly enhanced by the adjuvants, especially wetting agents, that may be present in the formulation.

76-0616. Paderova, V. P. (Tomsk Med. Inst., USSR). **Nekotoryye gigienicheskiye voprosy v svyazi s primeneniem gerbitsidov grupy 2,4-D. [Some hygienic problems related to the use of 2,4-D type herbicides.]** *Gig. Sanit.* 40(9): 96-97; 1975. (Russian)

Results of systematic measurements of 2,4-D residues in water samples from rivers, ponds, and wells in an area where 2,4-D had been used for weed control are reported. The 2,4-D concentrations measured were 0.7-1.3 mg/l in underground waters, 1-6.6 mg/l in river water, and 1.7-47 mg/l in pond water. The 2,4-D residues found 2.5 months later were 0.4-1.5 mg/l in underground waters, 0.5-2.9 mg/l in river water, and 0.7-1.4 mg/l in pond water. The findings indicate the presence of groundwater contamination where 2,4-D is used for weed control, and that 2,4-D persists in water in fairly high concentrations for a long time.

76-0617. Cornwell, P. B.; Hawkes, C. (Res. Dev. Div., Rentokil Ltd., Felcourt, East Grinstead, Sussex, England). **Penetration and persistence of organic-solvent preservatives, spray applied to *Pinus sylvestris*.** *Holzforschung* 29(1): 36-39; 1975. (3 references)

When *Pinus sylvestris*, treated with organic-solvent preservatives containing lindane, was aged for 3 yr under normal and accelerated conditions, the greatest losses of lindane were from the superficial layer (0-2 mm). Losses were smaller at greater depths, becoming minimal at 2-3 mm. The lindane concentrations increased below 10 mm, indicating continuing absorption of the organic-solvent preservatives for long periods after application. A bioassay technique was developed for evaluating the insecticidal profile of preservatives in treated timber. Results showed that the zone of complete protection from *Anobium punctatum* attack, 0-8 mm, remained unchanged, even after 3 yr equivalent accelerated aging in a wind tunnel. The factor by which the normal aging process was accelerated was estimated at ×12 for the outer 2 mm and ×4 for the 2-7 mm layer. Since the outer 8 mm remained toxic to *Anobium* larvae under stringent conditions of 'air leaching' and reinfestation requires penetration of the outer layers, organic-solvent preservatives containing 1% lindane can be expected to protect *P. sylvestris* against attack for at least 20 yr.

76-0618. Hsu, T. S.; Bartha, R. (Dep. Biochem. Microbiol., Cook Coll., Rutgers Univ., New Brunswick, NJ 08903). **Hydrolyzable and nonhydrolyzable 3,4-dichloroaniline-humus complexes and their respective rates of biodegradation.** *J. Agric. Food Chem.* 24(1): 118-122; 1976. (20 references)

Up to 90% of the 3,4-dichloroaniline released during the biodegradation of several phenylamide herbicides becomes unextractable by solvents due to binding to the soil organic matter. Bond stabilities and model reactions with monomeric constituents of humic substances suggest covalent binding of the residue by at least two distinct mechanisms. A 190-day laboratory experiment with radiolabeled 3,4-dichloroaniline demonstrated that the hydrolyzable and hence analytically accessible portion of the humus-bound residue declines with time, while the nonhydrolyzable portion does not, or does so at a much slower rate. The shifting ratio of hydrolyzable vs. nonhydrolyzable residue complexes frustrates current attempts to assess the true 3,4-dichloroaniline burden of agricultural soils that have experienced previous treatments by corresponding phenylamide herbicides. The practical significance of humus-bound residues as potential sources of crop contamination is discussed. (Author abstract by permission)

76-0619. Muir, D. C.; Baker, B. E. (Dep. Agric. Chem., Macdonald Coll., McGill Univ., Quebec, Canada). **Detection of triazine herbicides and their degradation products in tile-drain water from fields under intensive corn (maize)**

production. *J. Agric. Food Chem.* 24(1): 122-125; 1976. (10 references)

The herbicides cyanazine, cyprazine, atrazine, and metribuzin were applied (post-emergence) to plots which were drained by separate tile drains (depth 1.2-1.6 m). Water samples were collected from the tile outlets and extracted with ethyl acetate. In the first season of monitoring, herbicide concentrations ranged from 0.30 to 1.49 μg/l. for atrazine, from 0.000 to 0.68 μg/l. for cyanazine, and from 0.000 to 0.57 μg/l. for cyprazine. Similar levels of the chloro-*s*-triazine herbicides were found in the tile-drain water during the second year of the study. Metribuzin, which was applied during the second year, was found in the tile-drain water in concentrations ranging from 0.000 to 1.65 μg/l. The metabolites deethylated atrazine (2-chloro-4-isopropylamino- 6-amino-*s*- triazine) and cyanazine amide [2-chloro- 4-(1-carbamoyl- 1-methylethylamino)-6-ethylamino- *s*-triazine] and deisopropylated atrazine (2-chloro- 4-amino- 6-ethylamino- *s*-triazine) were detected at concentrations which were similar to those of the parent compounds. The discharge (grams/hectare) of herbicide residues in the tile-drain water was determined over a 9-month period. (Author abstract by permission)

76-0620. Skipper, H. D.; Volk, V. V.; Frech, R. (Dep. Agron. Soils, Clemson Univ., Clemson, SC 29631). **Hydrolysis of a chloro-*s*-triazine herbicide.** *J. Agric. Food Chem.* 24(1): 126-129; 1976. (11 references)

Chloro-*s*-triazine herbicides undergo hydrolysis in the environment to nonphytotoxic hydroxy analogs. Transitional forms of hydroxyatrazine [2-hydroxy-4-(ethylamino)-6-(isopropylamino)-*s*-triazine] were identified at different pH values through the use of infrared spectroscopy. The infrared spectra suggest the existence of enol, keto, and protonated-keto forms of hydroxy-*s*-triazines. The following sequential molecular transformations are correlated with changes in pH: (a) an anionic species at pH > 11.5, (b) an enol form between pH 11.5 and 3.3, and (c) a keto or protonated-keto species at pH < 3.3. (Author abstract by permission)

76-0621. Lane, R. H.; Grodner, R. M.; Graves, J. L. (Box 4132, Mississippi Coll., Clinton, MS 39058). **Irradiation studies of mallard duck eggs material containing mirex.** *J. Agric. Food Chem.* 24(1): 192-193; 1976. (12 references)

Eggs containing Mirex (dodecachloropentacyclo [5.3.0.$0^{2,6}$.$0^{3,9}$.$0^{4,8}$] decane) from mallard ducks (*Anas platyrhychos* l.), fed diets with the insecticide incorporated at levels of 1 and 100 ppm for 25 weeks, were subjected to ultraviolet (uv) and γ irradiation. Seven derivatives were obtained on photolysis and eight derivatives were obtained from γ irradiation. Irradiation products appeared to be mono and dihydro derivatives of Mirex. Structural assignments for two monohydro derivatives and their dihydro derivatives were made on the basis of retention time and mass spectral data. (Author abstract by permission)

76-0622. Buhler, D. R.; Claeys, R. R.; Mate, B. R. (Dep. Agric. Chem., Environ. Health Sci. Cent., Oregon State Univ., Corvallis, OR 97331). **Heavy metal and chlorinated hydrocarbon residues in California sea lions.** *J. Fish. Res. Board Can.* 32(12): 2391-2397; 1975. (27 references)

Samples of various tissues and organs from healthy California sea lions (*Zalophus californianus californianus*) and sick animals (apparently with leptospirosis) collected along the central Oregon coast in 1970, 1971, and 1973 were analyzed for total mercury, methylmercury, cadmium, and chlorinated hydrocarbons. Maximum mercury concentrations of 74-170 ppm occurred in sea lion liver, but only 1.6-3.7% of this was present as methylmercury. Cadmium was concentrated primarily in the kidney which contained 7.2-12.0 ppm of the metal. Chlorinated hydrocarbon residues in sea lion fat ranged between 253-475 ppm DDE and 21.2 and 34.1 ppm PCB. Athough mercury, cadmium, and chlorinated hydrocarbon residues in some of the sick sea lions were significantly higher than those present in healthy animals, it is not possible to relate these differences to the onset of leptospirosis. (Author abstract by permission)

76-0623. Kavadia, V. S.; Noor, A.; Gangwar, S. K. (Dep. Entomol., Univ. Udaipur, Udaipur 313001, India). **Residues of carbaryl in ridge gourd (*Lufa acutangula* Roxb.: Cucurbitacea).** *J. Food Sci. Technol. (Mysore)* 12(4): 200-201; 1975. (8 references)

Seeds of the edible ridge gourd var. 'Pusa nasdar' were sown at the rate of 5 kg a.i./ha at a distance of 50 cm on both sides of a 1 m wide sub-irrigation channel which divided the subplot of 7 m × 4 m into 2 halves. Three applications of carbaryl were given, first as 5% dust at the rate of 0.75 kg a.i./ha and second and third as suspensions 50% w.p. at the rate of 1.0 kg a.i./ha at two week intervals starting at the stage when plants were 4-6 wk old. The edible fruits were harvested at definite intervals. Carbaryl residues were analyzed by both spectrophotometric and enzymatic methods. The recoveries of carbaryl by spectrophotometric and enzymatic methods were 86.09 and 87.48%, respectively. There was a high degree of correlation between both methods of analysis. The carbaryl deposit of about 27.5 ppm on ridge gourd dissipated by about 94% in 6 days and was below detectable levels after 14 days. The half life obtained was about 2.6 days on ridge gourd.

76-0624. Vasuki, K.; Ghai, O. P. (Dep. Pediatr., All India Inst. Med. Sci., New Delhi-16, India). **A prelude to pesticide residues in different diagnostic situations.** *J. Food Sci. Technol. (Mysore)* 12(4): 203-204; 1975. (22 references)

Pesticide residues can be found wherever plant or animal life exists and the significance of trace residues in food on human health is debatable. Although demonstrable illness has rarely been brought about by pesticides, there is a potential threat of accumulation of minute quan-

tities of pesticides in human tissues. The route of absorption of pesticides into the human body is mainly through the gastrointestinal tract. The dietary intake of DDT of an adult in India is about 0.2664 mg/day. The residue in adipose tissue ranges from 12.8 to 31 ppm, high relative to other developed countries. Pesticides have also been located in spleen, bone-marrow and lung, gall stones, in milk of lactating humans, brain, liver and kidney, human placenta, cord, and blood. Screening for pesticide residues has been carried out in wide ranging age groups and in different diagnostic situations such as carcinoma cases, myocardial infarction, cerebral thrombosis, sepsis, leukemia, nephritis, local and general pathological conditions of the liver. The most commonly found pesticide residues are DDT, DDE, DDD, BHC, lindane, and dieldrin. The preferential levels in some tissues may be due to their fat solubility and lipophilic character. Such preferential absorption in the brain tissues resulted in electroencephalogram abnormalities. Pesticide exposures have also been incriminated in renal tubular dysfunction, amino acidemia and amino aciduria, hematologic abnormalities and associated effects.

76-0625. Scott, J. M.; Wiens, J. A.; Claeys, R. R. (Dep. Zool., Oregon State Univ., Corvallis, OR 97331). **Organochlorine levels associated with a common murre die-off in Oregon.** *J. Wildl. Manage.* 39(2): 310-320; 1975. (25 references)

During the summer of 1969 an abnormally high mortality of common murres (*Uria aalge*) was observed on the Oregon coast. Autopsy of dead birds suggested that drowning was the proximate cause of death. The body weights of dead males collected during the die-off period were significantly lower (x = 706 g) than those of healthy birds collected at the same time (x = 898 g) or in August of the following year (x = 1,181 g). Analyses for chlorinated hydrocarbons revealed an average *p,p'*-DDE concentration of 8.7 ppm wet weight in brain tissues of dead birds, whereas the level in healthy birds collected at the same time was 1.1 ppm. The ratio of *p,p'*-DDE in brain and muscle tissues (*p,p'*-DDE brain/*p,p'*-DDE muscle) averaged 28 in dead birds collected during the die-off. Collections of living birds in the summer of 1970 when there was no die-off indicated an average *p,p'*-DDE level of 0.44 ppm in brain tissues, and brain-to-muscle ratios did not exceed 0.97. Brain levels of polychlorinated biphenyls (PCBs) averaged 4.0 ppm in the dead birds, 3.7 ppm in the live birds collected during the die-off, and 1.1 ppm in the June 1970 sample. All *p,p'*-DDE and PCB levels were considerably less than reported lethal concentrations in other species of birds; however, under conditions of environmental stress, the levels recorded for dead birds in 1969 may have been sufficient to contribute directly or indirectly to mortality through effects on metabolism and behavior. (Author abstract by permission)

76-0626. Nalbandyan, R. A. (Azerbaydzhan Sci. Res. Inst. Plant Protect., USSR). **Ostatochnye kolichestva sevina i fozalona v list'yakh i yagodakh vinograda. [Residue levels of Sevin and phosalone in grape leaves and berries.]** *Khim. Sel'sk. Khoz.* 13(9): 72-73; 1975. (3 references) (Russian)

Carbaryl and phosalone residues in leaves and berries of grape were studied after three sprayings with 0.2% phosalone emulsion or 0.3% carbaryl emulsion at an expenditure of 1,000 l/ha. Residues were determined by thin-layer chromatography. Carbaryl residues in grape leaves were 2.2 mg/kg immediately after spraying, 0.19 mg/kg 15 days after the first spraying, 0.11 mg/kg 15 days after the second spraying, and 0.63 mg/kg 15 days after the third spraying. In berries, carbaryl residues were 1.6 mg/kg immediately after spraying, 0.1 mg/kg 15 days after the first spraying, 0.17 mg/kg 15 days after the second spraying, and 0.46 mg/kg 15 days after the third spraying. The carbaryl residue levels were between 0.32 and 0.51 mg/kg at vintage against a zero tolerance. The phosalone levels were 2.2 mg/kg in leaves and 1.9 mg/kg in berries immediately after spraying. Residue levels decreased by 85% and 1%, respectively, in 10 days. At vintage, the residue level in berries was 0.30 mg/kg against a MAC value of 0.20 mg/kg. In view of these findings, the waiting times before vintage are recommended to be 29-35 days for carbaryl and 20-25 days for phosalone.

76-0627. Matthey, E. (Eidg. Gesundheitsamt, Abt. Lebensmittelkontr., Bern, Switzerland). **Die Durchfuehrung der Lebensmittelkontrolle in der Schweiz im Jahre 1974. I. Bericht des Eidgenoessischen Gesundheitsamtes Abteilung Lebensmittelkontrolle. [Food Control in Switzerland in 1974. I. Report by the Federal Public Health Administration, Department of Food Control.]** *Mitt. Geb. Lebensmittelunters. Hyg.* 66(3): 308-346, 245; 1975. (German/French)

Food chemical analyses carried out in Switzerland in 1974 are reviewed. High levels of hexachlorobenzene were found in milk samples from one farm, possibly due to the illicit or careless use of this preparation. The lindane residues in milk indicate that this pesticide is still used in veterinary hygiene. Residue analysis in 613 samples revealed unacceptably high pesticide concentrations in 4% of domestic vegetables, in 16% of imported vegetables, in 5% of imported fruits, in 43% of Swiss cheese, in 33% of imported cheese, in 45% of milk samples, in 10% of baby food samples, in 4% of flour samples, and in 5% of tea. The residue levels were within the maximum allowable limits in butter, eggs, and domestic fruits.

76-0628. Love, J. L.; McGrath, H. J. W.; Donnelly, R. G. C. (Chem. Div., CSIR, P.B., Petone, New Zealand). **Mevinphos residues on strawberries.** *N.Z. J. Exp. Agric.* 3(2): 187-189; 1975. (3 references)

Strawberries from several areas in New Zealand were analyzed by flame photometric gas chromatography for mevinphos residues. The fruit was collected during the first 7 days after spraying by commercial growers. Mevin-

phos deposits of up to 4.2 mg/kg were found. The residues decayed with half-lives of 2-4 days, and all residue levels were below the New Zealand tolerance limit of 1 mg/kg 6 days after spraying. About 1/3 of the samples had residues above this limit 2 days after spraying. All of the samples which had excessive residue levels 2 days after spraying had come from the North Island. This is evidence that many North Island growers are applying mevinphos in excess of the recommended application rate of 0.22-0.45 kg a.i./ha. It is possible that some North Island pests have developed some resistance to mevinphos, in which case alternative chemicals will have to be used or the statutory waiting period will have to be increased.

76-0629. Vind, H. P.; Mathews, C. W. (Navy Civil Eng. Lab. , Port Hueneme, CA). **Biodeterioration of navy insecticides in the ocean.** *Natl. Tech. Inform. Serv.* AD-A007 568, 1975, 6p.

In a series of experiments designed to detect the presence of insecticides, matchsticks impregnated with a chlorinated hydrocarbon insecticide were employed as test specimens. They were exposed to seawater under a variety of conditions. Tests were conducted to determine whether the insecticides are degraded on the matchsticks or are leached from them by the water. Some tests were conducted in hot distilled water or seawater, some in cold, some in cultures of microorganisms and some in the ocean. Based on the results of such tests it is suggested that the water-insoluble chlorinated insecticides are transported in sea water primarily by being absorbed in the fatty cell membranes of microorganisms suspended in the water. It is further suggested that insecticides less fat-soluble than DDT would not enter the ocean food chain as readily. They would not be, therefore, as hazardous as DDT and yet might be just as toxic and persistent. Tests were recently begun on 26 different insecticides or related compounds in seawater. Although some of these were more toxic than others, all were very toxic to *Limnoria tripunctata*. The borers are unable to attack a matchstick until nearly all of the insecticide has been detoxified or removed. The insecticides included in this testing were: aldrin, bulan, chlorinated paraffin, chlordane, *m,p'*-DDD, *o,p'*-DDD, *p,p'*-DDD, *o,p'*-DDT, *p,p'*-DDT, Dicofol, dieldrin, endrin, heptachlor, hexachlorobenzene, isobenzan, kepone, lindane, methoxychlor, mirex, perthane, pentachlorophenol, prolan, strobane, TDE, tetradifon, and toxaphene.

76-0630. Snoeyink, V. L.; Kim, B. R.; Hinrichs, R. L.; Jennings, P. A. (Univ. Illinois, Urbana, IL 61801). **Synthetic resins and activated carbon for wastewater treatment.** *Natl. Tech. Inform. Serv.* AD-781 196, 1974, 74 p. (44 references)

The use of synthetic resins as adsorbents for water and wastewater treatment systems is described. The performance of the resins is compared with that of activated carbon. Many different types of resins are available, and the choice of one for a particular application depends greatly on the compounds to be adsorbed. A polystyrene-divinylbenzene resin with no functional groups, Amberlite XAD-4, has recently been developed for removing chlorinated pesticides from the effluent of a plant where they are produced. The capacity of the resin increased as the water solubility decreased. In adsorption studies with chlorinated pesticides, the capacity was excellent and the degree of column utilization was very high. At a flow rate of 0.5 gpm/ft^3, 50 bed volumes of a waste effluent which contained 118 mg/l of chlorinated pesticides were treated by XAD-4. Less than one mg/l of pesticide leakage occurred before a sharp breakthrough was noted. In comparisons with activated carbon, the XAD-4 proved far superior as an adsorbent. Acetone proved a most efficient means of regenerating pesticide-exhausted XAD-4. Isopropanol also gave good results: 10 bed volumes yielded 93% recovery for the resin vs. 13% for carbon.

76-0631. Harriss, R. C. (Mar. Lab., Florida State Univ., Tallahassee, FL). **Distribution of pesticides in a south Florida watershed. Appendix IV.** *Natl. Tech. Inform. Serv.* PB-231 684, 1973, 8 p. (2 references)

This report describes the results of a survey of pesticides in soils, canal sediments, and estuarine sediments in the Everglades watershed. In this study all pesticide analyses were done by gas chromatography. In almost all samples tested the total organochlorine content was below the detection limit of the analytical method used. These low and variable organochlorine contents of canal and estuarine sediments could be explained by three hypotheses. First, the organic-rich Everglades sediment may catalyze the degradation of organochlorine compounds and reduce their persistence. Second, the interaction of organochlorine compounds with the natural sediment organic matter may interfere with the standard extraction procedures; or the interaction with natural organics may also affect bioavailability. Third, sediment production rates may be sufficiently high to dilute the influx of pesticides at current application rates.

76-0632. Gaufin, A. R. (Montana Univ., Dep. Zool., Missoula, Montana). **The fate and effects of pesticides in the aquatic environment of the Flathead Lake drainage area.** *Natl. Tech. Inform. Serv.* PB-232 252, 1974, 50 p. (4 references)

A one-year preliminary sampling of pesticide practices on the Flathead Indian Reservation was conducted. Efforts were directed particularly at determining the effects of DDT on osprey survival and nesting on Flathead Lake, Montana. The results of this study indicate that Tordon (picloram) and other pesticide and herbicide contaminants are present in the Mission Valley ecosystem. The need was demonstrated for a comprehensive sampling program to elucidate the annual behavior of pesticides in culinary and sub-surface water supplies, and to correlate that behavior with runoff and climatic data. A rigorous program aimed at determining concentrations of pesticides

in fish and game and other wildlife is needed. A subsidiary monitoring program of fresh foods, including vegetables, meat, and dairy products is also indicated in light of the contamination of surface waters used for irrigation and stock watering. It is believed that contamination of the major surface, underground, and culinary waters with Tordon and other pesticides and/or herbicides was responsible for the catastrophic decline of the populations of many predatory birds, and also for the decline of the Flathead Lake osprey population.

76-0633. MacIntyre, W. G.; Smith, C. L.; Munday, J. C.; Gibson, V. M.; Lake, J. L. (Virginia Inst. Mar. Sci., Gloucester Point, VA). **Investigation of surface films — Chesapeake Bay entrance.** *Natl. Tech. Inform. Serv.* PB-232 968, 1974, 179 p. (3 references)

Indigenous surface films in the Chesapeake Bay mouth area were analyzed for lipid and chlorinated hydrocarbon content. The DDT concentrations were similar to those found in western streams. There was an average of 16 ppt *o,p*-DDT and *p,p'*-DDT in the transitory slicks. The DDT content of the only semi-permanent slick sampled by this study varied from 12 ppt to 41 ppt on the two sampling dates. Neither dieldrin nor aldrin was detected in these slick samples. PCBs corresponding in retention times to Aroclor 1254 were present. Depending on whether the slick is spread thinly over a large area or is relatively thick but covering a small area, chlorinated hydrocarbon concentrations vary according to the slick area exposed to the environment. It is suggested that, for future studies on surface films, a field surface film thickness measuring device should be developed. The data from this study indicate that the concentration of total chlorinated hydrocarbons in surface films is generally higher than the subsurface concentrations. PCBs seemed more uniformly distributed between surface and subsurface layers than DDT concentrations. Several possible explanations are given, including the fact that PCBs and DDT are likely carried in different physical states in the atmosphere— PCBs as gas and DDT on dust particles; PCBs and DDT enter the environment by different methods; and PCBs and DDT have different surface chemical properties.

76-0634. Takahashi, I.; Masui, A. (Pestic. Lab., Nippon Kayaku Co., Ltd., Ageo, Japan). [**Behavior of diazinon applied in paddy field, and investigation on suitable application period.**] *Nippon Oyo Dobutsu Konchu Gakkai-Shi (Jpn. J. Appl. Entomol. Zool.)* 18(4): 171-176; 1974. (5 references) (Japanese)

A study was made of the behavior of diazinon in the paddy field after water surface application. Diazinon was applied as 3% granules (3 kg/10 a). On the first day after application, 66 g diazinon was detected in water, 38 g in soil, 0.6 g in rice plant, and 3.6 g in a gaseous state in the air. On the second day a total of 75 g diazinon was found; on the fourth day, 21 g; and on the 15th day, only 2 g. The concentration of diazinon in the rice plant was dependent on the concentration of the chemical in the water. The concentration of 0.3 ppm diazinon in rice plants was enough to kill the larvae of the rice stem borer for 9 successive days. That is, the treatment was effective against the larvae which had infested the plant 4 days before and those which attacked the plant within 4 days after application.

76-0635. Loyttyniemi, K. (Dept. For. Protect., Finn. For. Res. Inst., Helsinki, Finland). **Lindaanin huuhtoutumisesta suojaruiskutetun mantykuitupuun kuoresta rumpukuorimon jateveteen . [Transfer of lindane from bark of insecticide sprayed pine pulpwood into the effluent from a barking drum.]** *Pap. Puu* 57(10): 666-668; 1975. (10 references) (Finnish)

The amount of insecticide residues in waste water from the barking drum of a pulp mill when pulpwood sprayed with insecticide is debarked was studied. The determinations were made at Valkeakoski, south Finland, in spring, 1974. Lindane in a concentration of 0.4% active ingredient was applied at 1.1 l/m³ to unbarked green pine pulpwood. Barking occurred 2 mo. later. Before barking, lindane levels averaged 11 mg/kg dry matter, and after the barking process, the lindane level was more than 50% lower. Lindane residues in waste water were 0.06-0.10 mg/l. Finnish legislation forbids methods for processing sprayed wood which would result in a discharge of lindane into the water system. Wood sprayed with insecticide cannot be barked in a wet barking drum if there is any chance of the waste water entering the waterways.

76-0636. Richins, R. T.; Risser, A. C., Jr. (Ada County Conc. Governments, Boise, ID 89502). **Total mercury in water, sediment, and selected aquatic organisms, Carson River, Nevada—1972.** *Pestic. Monit. J.* 9(1): 44-54; 1975. (37 references)

A 1971-72 study of the Nevada Carson River drainage system by the Geological Survey, U.S. Department of Interior, revealed substantial amounts of mercury from pre-1900 gold and silver milling operations of the Comstock Lode. A monitoring survey was initiated to determine the extent of mercury uptake from corresponding surface water and sediments for seven aquatic species collected from five sampling stations along the watercourse. Total mercury content in fish ranged from 0.02 to 2.72 ppm; highest concentrations occurred in piscivorous white bass (0.50-2.72 ppm) sampled from Lahontan Reservoir. Residue levels appeared to be related to fish size, as demonstrated by highly significant correlations between wet weight and mercury content of five of the six species. Concentrations also appeared to be directly influenced by the species' position on the aquatic food chain. These results indicate that mercury levels in some fish from the Carson River drainage system may exceed the 0.50 ppm maximum concentration considered by the Food and Drug Administration, U.S. Department of Health, Education, and Welfare, to be safe for human consumption. (Author abstract by permission)

76-0637. Stacey, C. I.; Thomas, B. W. (Dep. Chem., Western Aust. Inst. Technol., South Bentley, Western Australia). **Organochlorine pesticide residues in human milk, Western Australia—1970-71.** *Pestic. Monit. J.* 9(2): 64-66; 1975. (12 references)

Milk samples from 22 nursing mothers in the metropolitan area of Perth, Western Australia, have shown the presence of DDT, DDE, dieldrin, and HCB in amounts consistent with similar surveys in other countries. Although mean values tend to be slightly lower than expected, their wide range, 0.002-0.025 ppm for DDT, suggests that a much larger sample should be examined to obtain a more accurate mean. This view is supported by values obtained in another survey of the same area. (Author abstract by permission)

76-0638. Baskett, T. S. (Missouri Coop. Wildl. Res. Unit, Fish and Wildl. Serv., U.S. Dep. Inter., Univ. Missouri, Columbia, MO 65201). **Mercury residues in breast muscle of wild ducks, 1970-71.** *Pestic. Monit. J.* 9(2): 67-78; 1975. (18 references)

Samples of breast muscle from 327 ducks collected from October 1970 to March 1971 in the coterminous United States were analyzed for total mercury by flameless atomic absorption spectrometry. Mercury levels for the entire collection ranged from < 0.01 to 3.91 ppm wet weight with a median of 0.10 ppm. Twenty-five ducks had levels equaling or exceeding the 0.5 ppm guideline for fish and shellfish established by the Food and Drug Administration, U. S. Department of Health, Education, and Welfare. Dabbling ducks, which are shallow-water feeders and mostly vegetarian in fall, winter, and spring, usually had lower levels than diving and sea ducks. Levels were generally higher in ducks collected in areas where environmental mercury levels were known to be greater than in ducks from nonsuspect areas. Despite the mobility of the ducks, levels seemed more closely linked to local environmental contamination than to various factors associated with large geographic areas. (Author abstract by permission)

76-0639. Johnston, D. W. (Dep. Zool., Univ. Florida, Gainesville, FL 32611). **Organochlorine pesticide residues in small migratory birds, 1964-73.** *Pestic. Monit. J.* 9(2): 79-88; 1975. (46 references)

Chlorinated hydrocarbon pesticide burdens, especially those of DDT and its metabolites, have been determined for 19 species of small terrestrial migratory birds killed chiefly at Florida television towers from 1964 to 1973. All 128 samples were sorted into pools by species. All pooled samples except one contained DDE and often DDT and DDD; dieldrin was present in 60 of the samples, but no PCBs were detected. In small subsamples, $\sum$DDT (*p,p'*-DDT, *p,p'*-DDD, and *p,p'*-DDE) residues sometimes differed between males and females, adults and immatures, and northbound and southbound migrants, but results of these comparisons were inconclusive. $\sum$DDT burdens were highest in adipose tissue and much lower in liver and brain samples. Especially among birds taken since 1970 the pesticide levels in adipose tissue have been at low levels, generally less than 3 ppm $\sum$DDT. These low quantities are comparable to those quoted in other reports on birds of similar trophic levels. The insectivorous and/or partly granivorous birds feeding on or near the ground tended to have higher $\sum$DDT levels than did the more arboreal species. (Author abstract by permission)

76-0640. Klaassen, H. E.; Kadoum, A. M. (Div. Biol., Kansas State Univ., Manhattan, KS 66506). **Insecticide residues in the Tuttle Creek Reservoir ecosystem, Kansas—1970-71.** *Pestic. Monit. J.* 9(2): 89-93; 1975. (11 references)

Various components of the aquatic ecosystem of Tuttle Creek Reservoir on the Big Blue River in northeastern Kansas were examined for organochlorine insecticide residues in 1970-71. Components examined were water, sediments, periphyton, zooplankton, insects, and whole-body samples of 10 common fish species. Only dieldrin and $\sum$DDT residues were detected. Dieldrin was found in part of the nonfish samples at levels ranging up to 0.01 ppm and in 97 percent of the fish samples with a high level of 0.17 ppm. $\sum$DDT residues were also detected in part of the nonfish samples at levels ranging up to 0.42 ppm, and in 98 percent of the fish samples at levels as high as 0.57 ppm. Findings are roughly similar to those of other surveys of Kansas fishes. All levels are relatively low compared with those reported in surveys from other parts of the Nation. (Author abstract by permission)

76-0641. Manske, D. D.; Johnson, R. D.* (Kansas City Field Off. Lab., Food Drug Admin. U.S. Dep. Health, Educ., Welfare, Kansas City, MO 64106). **Pesticide residues in total diet samples (VIII).** *Pestic. Monit. J.* 9(2): 94-105; 1975. (13 references)

During the eighth year of the Total Diet Study, residues remained at the relatively low levels reported previously. A total of 35 market baskets were collected in 32 cities which ranged in population from less than 50,000 to 1,000,000 or more. Averages and ranges of residues found are reported for the period June 1971 through July 1972 by region and food class. Results of recovery studies within various classes of residues are also presented. (Author abstract by permission)

76-0642. Mattraw, H. C., Jr. (Geol. Survey, U.S. Dep. Inter., Miami, FL 33130). **Occurrence of chlorinated hydrocarbon insecticides, southern Florida—1968-72.** *Pestic. Monit. J.* 9(2): 106-114; 1975. (12 references)

The frequency with which chlorinated hydrocarbon insecticides appear in samples of southern Florida surface waters decreased sharply between 1968 and 1972. Sediment analyses attest to the earlier widespread use of chlordane, DDT, and dieldrin. Insecticide residues are more frequently detected in southern Florida than in other

U.S. cropland soils. Transport of DDT, DDD, and DDE from the Everglades agricultural area into water conservation areas and undeveloped parts of the Everglades of southeastern Florida is facilitated by a system of water-management canals. Canal sediments within the urban area of southern Florida have high DDD, DDE, and dieldrin residue concentrations which may reflect local use of insecticides rather than their transport from adjacent agricultural areas. (Author abstract by permission)

76-0643. Siddaramappa, R.; Sethunathan, N. (Lab. Soil Microbiol., Cent. Rice Res. Inst., Orissa, India). **Persistence of gamma-BHC and beta-BHC in Indian rice soils under flooded conditions.** *Pestic. Sci.* 6(4): 395-403; 1975. (18 references)

The relative persistence of [^{14}C]-γ-BHC (lindane) and [^{14}C]-β-BHC in Indian rice soils under flooded conditions was studied. In alluvial, laterite and pokkali (acid sulphate, saline) soils, rapid degradation of both isomers occurred; in sandy and kari (acid sulphate, saline) soils, both isomers persisted even after 41 days of flooding. The rapid degradation of BHC isomers in the former three soils was related to highly negative redox potentials within 20 days of flooding in contrast to oxidized conditions in sandy and kari soils even after 41 days. During the degradation in the soils, β-BHC showed a longer lag than γ-BHC. Results suggest that the degradation of beta-BHC commences at a potential lower than that required for γ-BHC degradation. Greater decomposition of γ-BHC occurred in rice straw-amended soils than in unamended soils when the insecticide was incorporated to the soils in an aqueous solution. Addition of BHC isomers to the soils in ethanol resulted in comparable rates of rapid decomposition in both rice straw-amended and unamended soils, since ethanol was as effective as rice straw in lowering the redox potentials of the soils favoring BHC decomposition in unamended soils as well. (Author abstract by permission)

76-0644. Hamseed, S. F.; Sood, S. K. (Plant. Protect. Chem. Sect., East Malling Res. Stn., Maidstone, Kent, England). **Factors influencing the persistence of organophosphorus insecticides in soil.** *Pesticides* 8(7): 45-50; 1974. (57 references)

Various soil factors influence the persistence of insecticides in soil. Each factor may act upon the insecticide individually but the total of effects produced by these factors determines the persistence of the insecticide. Soil temperature and moisture are important. For example, soil bacterial numbers increase with increasing moisture content and variations in temperature. It has been shown that temperature influences insecticide persistence. The major factors governing dissipation of the residues, such as volatilization and chemical and microbial degradation, are all temperature dependent. Some studies indicate that the persistence and volatility of insecticide residues in soil is proportional to the amount of soil moisture. Soil type has a strong influence on organophosphorus compounds. Persistence of biological activity is dependent on the rate of degradation by chemical and biological means. In soils with high organic matter content, there appears to be a high degree of initial sorption, followed by further sorption and inactivation in subsequent weeks. Organophosphorus insecticides are also inactivated by the mineral fraction in dry soil and to a lesser extent in the heavy mineral soils. The clay minerals, which bond metallic cations more strongly than do montmorillonite and organic soils, allow little or no rapid hydrolysis. Adsorption plays a significant role in pesticide persistence and degradation. Adsorption processes are exothermic and desorption processes are endothermic. An increase in soil temperature results in desorption of the insecticide and an increase in biological activity. The process is reversible; as soil temperature decreases, the insecticide is adsorbed and inactivated. Varying pH conditions of different soils affect the hydrolysis and degradation of pesticides. The pH of the soil is generally influenced by carbon dioxide concentrations. Other factors affecting the persistence and degradation of insecticides include the base or cation exchange capacity, uptake and leaching, soil microorganisms, and organic matter.

76-0645. Reifenstein, H.; Pank, F. (Inst. Pflanzenschutzforsch. Kleinmachnow, DDR). **Triazinrueckstaende an Arzneipflanzen. [Triazine residues on medicinal plants.]** *Pharmazie* 30(6): 391-393; 1975. (16 references) (German)

Camomile (*Matricaria chamomilla* L.), peppermint (*Mentha piperita* L.), sage (*Salvia officinalis*), yarrow (*Achillea millefolium* L.), and thyme (*Thymus vulgaris* L.) were investigated for residues of simazine, atrazine, prometryne, and desmetryne. The pesticides were applied several weeks to months before harvesting. Simazine residues up to 0.05 ppm were found in peppermint plants grown on fields that had been treated with 1.25-1.5 kg/ha simazine for several years. The residue levels in the soil were between 0.025-0.1 ppm. The residue levels in camomile, sage, thyme and yarrow were consistently below 0.02 ppm on fields treated with simazine (1 kg/ha), atrazine (1 kg/ha), prometryne (0.8-1 kg/ha), or desmetryne (0.2-0.3 kg/ha). The findings indicate that triazine derivatives present no residue toxicological hazards in these medicinal plants.

76-0646. Abd-Allah, M. A.; Abu-Salem, F. M.; Ismail, F. A. (Fac. Agric., Dep. Food Sci., Ain-Shams Univ., Cairo, U.A.R.). **Fungicidal residues on and in Egyptian oranges.** *Qual. Plant. Plant Foods Hum. Nutr.* 24(1/2): 127-136; 1974. (8 references)

Navel and Baladi Egyptian oranges were analyzed for diphenyl, Na-orthophenyl phenate, and thiabendazole residues. Na-orthophenyl phenate had been used as a rinse water during the commercial application of fungicidal dips and wrapping treatment of the fruit, thiabendazole had been used as a fungicide incorporated into the wax, and

diphenyl had been used to impregnate the wrapping papers for the oranges. The maximum fungicide residues on and in the oranges were less than the maximum permissible concentration for human consumption recommended by the FAO/WHO committees. The fungicide residues on the surfaces of the oranges were higher than those within the fruit pulp. The fungicide residues decreased more rapidly during 5 weeks storage at room temperature than during storage at 42°F.

76-0647. Bencivenga, B.; Pallotti, G.; Botre, C.; Mancini, G. (Lab. Prov. Ig. Profilassi, Rome, Italy). **Indagine su residui di pesticidi cloro-organici in campioni di latte intero della "zona bianca" del Comune di Roma. [Residues of organochlorine pesticides in samples of whole milk of the White Zone of Rome.]** *Rass. Chim.* 25(3): 271-273; 1975. (11 references) (Italian)

The "white zone" was divided into three areas, and a total of 78,530 liters of milk (approximately half of the daily production in the zone) were collected. Physical and chemico-physical characteristics of all the samples were determined. Of a total of 138 samples, 42 were chosen for detection of organochlorine pesticides. Following homogenization, 100 g of each sample was analyzed by the Onley method. The apparatus employed was a Carlo Erba Fractovap GI model. Temperatures were 280°C at the base of the detector, 190°C for the column, and 240°C for the injector. All analyzed samples were compared to a control containing a mixture of pesticides including lindane, heptachlor, aldrin, heptachlor epoxide, *p,p'*-DDT, dieldrin, and *o,p'*-DDT. Tabulated results indicate that all analyzed samples, except two, contained measurable residues of organochlorine pesticides. The total absence of aldrin and heptachlor is explained by the fact that they are oxidized in the soil and metabolized in the animal. Quantities of pesticides detected ranged from 0.001 ppm to 0.012 ppm. The total median from the three zones, 0.006 ppm, indicates that the milk samples contained residues of organochlorine pesticides in quantities ten times inferior to the maximum limits (0.064 ppm) established by the FAO/WHO. The limits of individual pesticides were rarely reached or surpassed. Such results imply that the residues are more likely due to pollution from the natural surroundings than due to excessive agricultural usage.

76-0648. Willett, L. B.; Hess, J. F., Jr. (Dep. Dairy Sci., Ohio Agric. Res. Dev. Cent., Wooster, OH 44691). **Polychlorinated biphenyl residues in silos in the United States.** *Residue Rev.* 55: 135-147; 1975. (46 references)

Polychlorinated biphenyls (PCBs) have been applied commercially to a wide range of products for over 40 years. Since PCBs are chemically inert they resist degradation and are, therefore, found throughout the global ecosystem and can accumulate up the food chain. Many of the PCBs which are widely dispersed in our environment have little importance when considering the accumulation of PCBs in man. The direct contamination of food products with PCB residues is the main contamination source for human beings. One use of PCBs that led to the contamination of dairy products was a coating used on the inside of farm silos. The coating responsible for most, if not all, of the PCB-contaminated silos was called Cumar and was used in the eastern half of the United States between 1941 and 1970. The PCB (Aroclor 1254) that was a component of this coating was dissolved by organic acids produced during the ensiling process. The PCB residues then diffused into the silage. Detected residue concentrations in silage adjacent to silo walls have been greater than 7,000 ppm. When PCB-contaminated silage was fed to livestock the residues accumulated in the body fat and deposited in the fat portion of milk. When the source of PCBs was withdrawn from dairy cattle the concentration in milk fat declined rapidly and can be described by a two-component first-order system equation. It has been estimated that 5,000 to 6,000 silos have been treated with coatings containing PCBs. However, the number of contaminated silos is declining as they are being abandoned, torn down, or decontaminated with barrier coatings. Surveys have indicated that PCB residues could be detected in milk from about 7% of the farms investigated. Many of the detectable residues were below the FDA temporary tolerance of 2.5 ppm on a fat basis. (Author abstract by permission)

76-0649. Hayes, M. H. B.; Pick, M. E.; Toms, B. A (Dep. Chem., Univ. Birmingham, P.O. Box 363, Birmingham, England). **Interactions between clay minerals an bipyridylium herbicides.** *Residue Rev.* 57: 1-25; 1975. (6 references)

Concepts of the structures of the bipyridylium herbicides, diquat and paraquat, and of clays are briefly outlined and some discussion is given to the properties of these substances which are important in order to understand adsorption processes. The enthalpy changes and some entropy effects which are involved when these herbicides are adsorbed by different homoionic clay preparations are discussed and some emphasis is given to the conformations adopted by the organocations when adsorbed by the different clays. Some emphasis is also given to studies on the adsorption by montmorillonite and vermiculite preparations of pyridinium compounds and of bipyridyls with structures related to those of paraquat and of diquat. In a qualitative discussion attention is drawn to plausible mechanisms which might be involved in the adsorption processes. (Author abstract by permission)

76-0650. Harris, C. R.; Miles, J. R. W. (Res. Inst., Agric. Can., Univ. Sub Post Office, London, Ontario, Canada). **Pesticide residues in the Great Lakes region of Canada.** *Residue Rev.* 57: 27-79; 1975. (94 references)

The southwestern portion of the province of Ontario, because of its geographical location and economic development, provides an ideal model ecosystem for a study on the use, distribution, and fate of pesticides in the environment. Pesticides have been used widely in south-

ern Ontario in agricultural, urban, and recreational areas. The research effort on the fate of pesticides in the environment has been concentrated on insecticides, particularly the organochlorine insecticides DDT and aldrin/dieldrin. Significant residues of these insecticides are present in orchard>vegetable>tobacco soils, with insignificant residue levels in field crop soils. Agricultural insecticide residues are concentrated in small pockets of land comprising about 0.1% of the land acreage of the province. There is no indication that these residues have had long-term effects on microorganisms influencing soil fertility. Several species of soil insects have become resistant to the cyclodiene insecticides. Monitoring programs indicate low levels of some organochlorine insecticides on agricultural crops and unacceptable levels of DDT and dieldrin in milk and animal products. Most uses of DDT and all uses of aldrin, dieldrin, and heptachlor were banned in Ontario in 1969. Research and monitoring studies indicate that (1) DDT and, to a lesser extent, dieldrin are present in Lake Ontario>Lake Huron>Lake Erie, and (2) recreational and urban uses of insecticides have been the major source of contamination. Residues of other organochlorine insecticides such as heptachlor or chlordane do not present a significant problem in the Ontario environment at present. Organophosphorus and carbamate insecticides now receiving wide use are generally less residual on crops and in soils. They are applied more often than were the persistent organochlorine insecticides. There is some evidence of accumulation of residues of some of these materials in agricultural soils, primarily in organic soils used for vegetable production. It appears that soil microbial activity is not significantly influenced by residues of these insecticides or their metabolites. Some organophosphorus and carbamate insecticides are toxic to beneficial soil animals. Residues of some organophosphorus insecticides have been detected in sediment and water in drainage systems adjacent to organic soils used for vegetable production. Information on the fate, mobility, and environmental impact of other types of pesticides in the lower Great Lakes is minimal. Monitoring programs can be useful in pinpointing problem areas, but the only real solution, it is suggested, is to reduce input of the contaminant into the environment. (Author abstract by permission, abridged)

76-0651. Spencer, W. F. (U. S. Dep. Agric., P.O. Box 112, Riverside, CA 92502). **Movement of DDT and its derivatives into the atmosphere.** *Residue Rev.* 59: 91-117; 1975. (98 references)

The primary means of DDT entry into the atmosphere are by spray drift during the application process; by volatilization from treated surfaces including plants, water, and soils; and by wind-blown dust particles from soil surfaces containing DDT residues. During years when DDT was widely used in the United States, spray drift during the application process seemed the most dominant means of entry into the atmosphere, and will probably continue to be so in areas where DDT is still being used in relatively large amounts. In areas where DDT use has been curtailed or discontinued, the persistence of DDT residues is such that they will continue to be redistributed for many years after DDT applications cease. In these areas, volatilization from the soil probably will be the main source of DDT components moving into the atmosphere. During years when DDT is used heavily, the various components enter the atmosphere about in the same ratio as the vapor components associated with technical DDT. In subsequent years, the ratio of *p,p'*-DDT to other DDT components will decrease and will be in proportion to the degree of degradation of the *p,p'*-DDT to other compounds, such as *p,p'*-DDE and *p,p'*-TDE, which are more volatile than the parent compound. Evidence is presented on mechanisms and factors that influence volatilization rates, including the chemical and physical properties of the DDT components and their relative volatility. Data are presented on measured and potential volatilization rates, evidence for spray drift during application, and conditions controlling the amount of pesticides lost into the atmosphere during application. Reported atmospheric concentrations of DDT in various locations and the possible fate of the airborne DDT components are discussed. DDT is probably lost from the atmosphere by rainout, fallout of particulate matter, or by photochemical degradation into other compounds. The evidence indicates that DDT, or its degradation products, will be entering the atmosphere for many years after DDT use is terminated. (Author abstract by permission, abridged)

76-0652. Toniolo, L. (Cent. Stud. Diserbanti, Padova, Italy). **Attivita scientifica svolta nel 1973. [Scientific activity performed in 1973.]** *Ric. Sci.* 44(5): 828-832; 1974. (Italian)

The persistence of atrazine in a corn-growing soil is being studied in relation to nitrogen fertilizer and the burying of farm wastes, at the Agrarian Center of the University of Padua. After 8 years of continuous corn cultivation with 2 kg/ha/yr of atrazine, no significant amounts of the herbicide were found in the soil. However, during the two preceding years, concentrations of 100 to 500 g/ha were found. A project, started in 1972 and designed to evaluate the influence of a biological fertilizer (Regenor) on the persistence of atrazine in the soil, indicates that the fertilizer has very little effect on atrazine. It was also found, in another study, 10 months after the application of a number of products, that there were no traces of diuron (1.6 kg/ha), trifluralin (0.7 kg/ha), and prynachlor (4.5 kg/ha) in the soil. The treatment of sugar beets with herbicides revealed that nortron (fluorimidine) (15.5 kg/ha), and pyramin (pyrazon) and ro-neet (cycloate) (2.5 and 4 kg/ha) left residues in the soil. Studies on the persistence of asorgan and dalapon, both applied in late July and sampled in December, did not reveal significant quantities of the substance in the soil.

76-0653. Miyachi, H.; Inoue, I.; Nakazawa, H.; Tsuruta, O. (Ekika Tansan Co., Ltd., Tokyo, Japan). **[Studies on a fumigant, ethylene oxide, part 8: on the residue of a mixture of ethylene oxide and methyl bromide in brown rice and the**

formation of hydrins.] *Shokuhin Eiseigaku Zasshi (J. Food Hyg. Soc. Jpn.)* 16(6): 375-380; 1975. (20 references) (Japanese)

Brown rice fumigated with a gaseous mixture of ethylene oxide and methyl bromide (13-14% and 85-86% by weight) was examined as to the time change of the residue of these pesticides and the formation of hydrins. Although a minute amount of the gases penetrated into the tissue of fumigated brown rice, the residues became undetectable after 48 hr of fumigation with the dose of 10 g/m^3, or 96 hr with 21 g/m^3 in an experimental chamber or in a commercial warehouse. However, 1.0-1.4 ppm of ethylene chlorohydrin and ethylene bromohydrin were detected in the brown rice fumigated with 21 g/m^3. However, no residue of the hydrins could be detected with a 15.75 and 10.5 g/m^3 fumigation dose. In the actual warehouse (at ordinary temperature) the hydrins were not detected after fumigation with the dose of 10.5 g/m^3 specified by the government.

76-0654. Cirilli, G.; Massari, M.; Tanga Arduini, A. M. (Lab. Chim. Tecnol. Sper., Molitec., Bologna, Italy). **Sulla presenza di aldeide formica nei grani e nelle farine.** [**Formaldehyde in wheats and flours.**] *Tec. Molitoria* 24(6): 133-136; 1973. (4 references) (Italian)

Analytical studies on the presence of formaldehyde in wheats and flours show that a flour made from a grain untreated with insecticides which induce the development of oxaldehyde ($C_2H_2O_2$) never contains more than 2 ppm of formaldehyde. HCOH develops as a result of the combination of piperonyl butoxide (PB) and pyrethrin insecticides, attaches itself to the starch, and is never found in quantities greater than 3 ppm if the disinfestant treatment is administered preventatively. The flours which come from untreated grain usually do not contain more than 2 ppm. PB acts as a synergist with pyrethrin and is soluble in oil, methanol, ethanol, benzene, and common organic solvents; it is lethal in dosages of 11.5 g/kg and, in dosages greater than 3 g/kg, it causes vomiting and diarrhea. Formaldehyde, or products which produce it, could be applied unconsciously when used as a bacteriostat or antibacterial in the disinfection of the water of the grain washer. The effect of such a treatment on the glutinous reticulum is irreversible; it reduces it, thereby usually improving the grain, especially if it contains an excess of gluten.

76-0655. Englert, H. K. (Author address not given). **Rueckstandsuntersuchungen auf chlorierte Kohlenwasserstoffe bei Fallwild und bei gesund geschossenem heimischen Wild.** [**Residue analyses of chlorinated hydrocarbons in deceased wild animals and healthy hunted native wild animals.**] *Umweltschutz* 28(11, Suppl.): 367-369; 1975. (2 references) (German)

Results of systematic organochlorine pesticide residue analyses in deceased and healthy hunted game in West Germany are presented. Roes and hares contained lindane, heptachlor, heptachlor epoxide, *p,p'*-DDE, aldrin, and dieldrin residues usually well below the maximum allowable concentrations. Hexachlorobenzene residues were above the acceptable limit in an increasing number of cases. The pesticide residues were about 10 times higher, but still below toxic concentrations in carnivorous species, such as foxes and martens. It was possible to establish a correlation between the intensity of agriculture and the pesticide residue level in the game shot in that particular area only for DDE. There was practically no difference in the pesticide residue levels between healthy shot and deceased animals, and there was no correlation between the residue levels and the age of the animals. The findings do not justify any relationship between exposure to pesticides and diseases among the animals. There were no acute game poisonings due to pesticides during the past decade.

76-0656. Seaburn, G. E.; Aronson, D. A. (U.S. Geol. Surv., U.S. Dep. Inter., Washington, DC). **Influence of recharge basins on the hydrology of Nassau and Suffolk Counties, Long Island, New York.** *U.S. Geological Survey Water-Supply Paper* 2031, 1974, 66 p. (44 references)

An investigation of recharge basins on Long Island was made by the U.S. Geological Survey in cooperation with the New York State Department of Environmental Conservations, the Nassau County Department of Public Works, the Suffolk County Department of Environmental Control, and the Suffolk County Water Authority. The hydrology of three recharge basins in Westbury, Syosset, and Deer Park was studied. Determinations were made of the average percentage of precipitation flowing into each basin, infiltration rate, the rate of movement of storm water through the unsaturated zone below each basin, the effect of rainfall on the peak rise of the water table, the average annual ground-water recharge, the chemical composition of the precipitation into the basins, and the chemical composition of the inflow to the basins. Only three pesticides were detected. A maximum DDT concentration of 0.08 μg/ml was determined for an inflow sample to the Westbury basin. The concentrations of the other pesticides were 0.02 μg/l or less. The total pesticide concentration in the soil layers on the basin floors generally ranged from 0.4-40 mg/l. Pesticides as well as other organic material appeared to be effectively reduced or removed from the infiltrating water in the soil layer. Ground-water recharge in the areas where recharge basins are used is probably equivalent to or may slightly exceed recharge under natural conditions.

76-0657. El-Dib, M. A.; Ramadan, F. M.; Ismail, M. (Water Pollut. Control, Natl. Res. Cent., Sh. El-Tahrir, Dokki, Cairo, Egypt). **Adsorption of sevin and baygon on granular activated carbon.** *Water Res.* 9(9): 795-798; 1975. (9 references)

Some of the factors which control the efficiency with which granular carbon columns remove carbamate insecticides from polluted water were studied. Granular

activated carbon (1.2 and 0.6 mm particle size) was added to known amounts of sevin (carbaryl) or baygon (propoxur) and shaken for 3 days. The carbamate concentrations in the aqueous phase were determined and the adsorption results applied to both Freundlich's and Langmuir's equations. Pesticide adsorption by granular activated carbon columns was also determined under fixed bed conditions. The adsorption parameters of Freundlich and Langmuir isotherms were shown to be useful indicators of the adsorption capacity of the activated carbon and of the anticipated sharpness of the breakthrough front. The adsorption of sevin and baygon depended on their chemical structure and degree of branching of the side chains. Contact time tended to be the most important factor controlling the efficiency of the adsorption process, and a linear relationship was obtained between the logarithm of contact time and the volume of effluent passing through the column before the breakthrough of sevin.

76-0658. Leistra, M.; Smelt, J. H.; Zandvoort, R. (Lab. Res. Insecticides, Wageningen, The Netherlands). **Persistence and mobility of bromacil in orchard soils.** *Weed Res.* 15(4): 243-247; 1975. (10 references)

Bromacil was applied annually for 6 or 7 years in two apple-orchard experiments. At intervals of a year after the last applications, concentrations at various depths down to more than 1 m were measured by gas-liquid chromatography. On an average, 54% of the annual dosage was still present, corresponding to a decline to 35% of the initial amount within a year. The highest concentration in the profile was found at about 10-20 cm, which indicates a much lower mobility than that found with soil thin-layer experiments. Traces of bromacil were found at depths around 1 m, especially with the higher dosages. The upper limits of the amount leaching below a depth of 1 m were estimated at less than 3% of the dosage. (Author abstract by permission)

76-0659. Bowmer, K. H.; Lang, A. R. G.; Higgins, M. L.; Pillay, A. R.; Tchan, Y. T. (Div. Irrig. Res., Griffith, N.S.W., Australia). **Loss of acrolein from water by volatilization and degradation.** *Weed Res.* 14(5): 325-328; 1975. (12 references)

The loss of acrolein by volatilization and degradation from a large tank of water is described. The standard analytical method for carbonyl compounds, a colorimetric reaction with dinitrophenylhydrazine, did not distinguish acrolein from a relatively non-volatile and non-toxic reaction product. In a modification of the method to correct the error, acrolein was separated from reaction products by scrubbing with air. Although acrolein is sufficiently volatile to use air-scrubbing to separate it from reaction products, its loss by evaporation from an open tank was much less than its loss by reaction in the local irrigation water. In other waters differences in chemical properties could affect the loss of acrolein by reaction, and greater turbulence is expected to increase loss by volatilization. (Author abstract by permission)

76-0660. Pesendorfer, H. (Bundesstaatl. Anst. Exp. Pharmakol. Balneol. Unters., Vienna, Austria). **Rueckstaende von Organochlorpestiziden (DDT u.a.) und polychlorierten Biphenylen (PCB's) in der Muttermilch (aus dem Raum Wien und Niederoesterreich). [Organochlorine pesticide (DDT, etc.) and polychlorinated biphenyl (PCB) compound residues in human milk (from the area of Vienna and Lower Austria).]** *Wien. Klin. Wochenschr.* 87(21): 732-736; 1975. (58 references) (German)

Twenty-two human milk samples from Vienna, and 9 milk samples from Mistelbach, a village in Lower Austria, were analyzed for organochlorine pesticide and PCB residues by the standard method (extraction with a mixture of ethanol, diethylether and *n*-pentane after addition of potassium oxalate, clean-up, and quantitative gas-chromatography). The recovery rates ranged from 83 to 100%. In Viennese samples, the mean concentrations, on milk fat basis, were 1.24 ppm for BHC, 0.048 ppm for lindane, 0.2 ppm for β-BHC, 3.38 ppm for DDE, 1.06 ppm for DDT, and 1.54 ppm for PCBs. The mean levels found in the Mistelbach samples were 3.67 ppm for BHC, 0.063 ppm for lindane, 0.28 ppm for β-BHC, 3.92 ppm for DDE, 1.76 ppm for DDT, and 1.29 ppm for PCBs. The total chlorinated hydrocarbon content was 7.47 ppm in Vienna, and 10.98 ppm at Mistelbach, the difference being statistically significant. The negligible difference in the DDE and DDT levels between the samples from Vienna and Mistelbach is due to the fact that the use of DDT in the agriculture has been practically discontinued during the last years. The findings indicate that the pesticide intake by babies with mothers' milk may often be higher than the acceptable daily intake.

76-0661. Clauss, B.; Acker, L. (Inst. Lebensmittelchem. Westfaelische Wilhelms-Univ., D-4400 Muenster, Germany). **Zur Kontamination von Milch und Milcherzeugnissen mit chlorierten Kohlenwasserstoffen im westfaelischen Raum. II. Ergebnisse und Diskussion. [On the contamination of milk and milk products with chlorinated hydrocarbons. II. Results and discussion.]** *Z. Lebensm.-Unters.-Forsch.* 159(3): 129-137; 1975. (21 references) (German)

Milk and butter samples from 20 dairies were analyzed for organochlorine pesticide and PCB residues (August 1972 to January 1974). Hexachlorobenzene, α-, β-, and γ-BHC, heptachlor epoxide, DDT, DDE, DDD, dieldrin, and PCBs were found in all milk and butter samples, while aldrin, heptachlor, and *o,p'*-DDT were not found. The residue levels in milk averaged, on fat basis, 0.182 ppm for hexachlorobenzene, 0.037 ppm for α-BHC, 0.033 ppm for lindane, 0.017 ppm for heptachlor epoxide, 0.015 ppm for dieldrin, 0.026 ppm for *p,p'*-DDE, 0.027 ppm for *p,p'*-DDT, 0.027 ppm for *p,p'*-DDD, and 0.38 ppm for PCBs. Seasonal variation with highest levels during the winter months was observed in the case of hexachlorobenzene, α-BHC, and lindane, and the variations were attenuated for DDT, DDE, and heptachlor epoxide. The PCB levels were independent of season and of the source

of the samples. Relationship was found between the hexachlorobenzene levels and the use of this fungicide in the area from which the sample was taken. Butter processing caused no noticeable changes in the pesticide residue levels, and metabolism did not play any role either. The high residue levels found in the colostrum during the initial phase of the lactation period showed a decline with the progression of the lactation.

See also **76-0792** **76-0797** **76-0823** **76-0839**

76-0662. Freemon, F. R. (Neurol. Service, Nashville Vet. Hosp., Nashville, TN). **Causes of polyneuropathy.** *Acta Neurol. Scand.* 51(S59): 7-43; 1975. (304 references)

Reports are assembled which attempt to show a relation between a disease, toxin, or therapeutic agent and the peripheral neuropathy syndrome. A wide variety of chemical agents disrupt the precarious metabolic interrelationship of the nerve axon and its Schwann cell coverings to produce the polyneuropathy syndrome. Heavy metals are the most common toxic cause of polyneuropathy. Included among these cases are suicide attempts using arsenical rat poisons. Arsenic produces a painful polyneuropathy, mercury an almost pure motor one. Therapy in most of the toxic neuropathies centers on removal of the patient from chronic exposure to the toxin. Medical therapy may accelerate elimination of the toxin. The use of chelating drugs has been studied, and dimercaprol is recommended for mercury and arsenic. Chronic exposure to the herbicide, 2,4-D, and related compounds can produce polyneuropathy, as can prolonged exposure to DDT and methyl bromide.

76-0663. Degreef, H.; Roelandts, R. (Dep. Dermatol., Kath. Univ. Leuven, Louvain, Belgium). **Arsenical intoxication due to pollution.** *Arch. Belg. Dermatol.* 30(1): 35-38; 1974. (11 references)

Two cases of arsenical poisoning due to pollution are reported. A 32-yr-old patient presented with a hyperkeratosis palmoplantaris. Paresthesia and loss of power in the extremities were also noted. Eleven years earlier the patient had been hospitalized, along with his entire family, for an acute arsenical intoxication caused by drinking water. One brother died from this exposure. Dermatological signs of chronic arsenicism occurred both in the patient and in his 64-yr-old father. The 32-yr-old son presented large cone shaped keratoses on both palms and soles. Hyperkeratosis with a slight acanthosis and without any nuclear or nucleolar abnormality of the basal layer was noted. The only clinical symptoms of acute intoxication were neurological rest symptoms. The father presented with keratoses on palms and soles, but also had several basal cell and intraepidermal carcinomas. Neurological rest symptoms were noted. A year and a half later, the son's condition was unchanged. The father showed new basal cell carcinomas and lesions of Bowen's disease on the abdomen, on the head and on the scrotum. A deeply infiltrating suppurating and fistular process was observed in the left groin, without lymph node invasion. Diagnosis was made of an undifferentiated invasive squamous cell carcinoma. This lesion was treated with betatron (5400 R). A relapse occurred and a large surgical excision was necessary. A brief review is presented of other known cases of chronic arsenicism due to pollution.

76-0664. Davies, J. E.; Barquet, A.; Freed, V. H.; Haque, R.; Morgade, C.; Sonneborn, R. E.; Vaclavek, C. (Univ. Miami Sch. Med., Miami, FL 33152). **Human pesticide poisonings by a fat-soluble organophosphate insecticide.** *Arch. Environ. Health* 30(12): 608-613; 1975. (24 references)

In five cases of dichlofenthion poisoning due to suicidal ingestions, unusual toxicologic features were encountered. Initial symptoms were mild or delayed, and severe cholinergic crises did not appear until 40 to 48 hours after ingestion. Two patients died, and in the three survivors, cholinesterase symptoms persisted for five to 48 days. An almost total inhibition of both cholinesterase enzymes continued in one patient for 66 days, and prolonged antidotal therapy was required. Residues of the intact pesticide were detected in fat after 54 days in one patient, and in the blood for 75 days in another patient. The partition coefficient of dichlofenthion in fat was 20 times greater than parathion, and exceeded only by leptophos. Considering the chemical and toxicologic properties of this compound, we postulated that the mechanism of protracted intoxication is a slow release from adipose reservoirs. (Author abstract by permission)

76-0665. Leghar, J. (Union Caisses Cent., Mutualite Agric., Paris, France). **Les handicapes en agriculture. [The handicapped in agriculture.]** *Arch. Mal. Prof. Med. Trav. Secur. Soc.* 35(1-2): 145-152; 1974. (French)

Medical, psychological, social, and economic aspects of the employment of handicapped persons in agriculture are described. Before entering employment, handicapped persons should undergo thorough training regarding the hazards involved in farm work, among which poisoning hazards due to the handling, storage, and application of pesticides are prominent. A summary of legislation which deals with this situation is presented, as well as a discussion of the role of medicine in confronting and helping to solve the various problems involved.

76-0666. Goulding, R. (Poisons Unit, Guy's Hosp., London, England). **Chemical hazards in the home.** *Br. Med. Bull.* 31(3): 191-195; 1975. (27 references)

In England and Wales, 99,800 persons were hospitalized during 1971 for poisoning. This figure included between 15,700 and 16,700 children under 5 yr of age, most of whom had consumed drugs, medicines, or household products. Measured against the total mortality of children under 5 yr of age, poisoning offers an almost insignificant contribution. Particular poisons encountered in the household include gases and vapors, various household products, indoor and garden plants, medicines, alcohol, miscellaneous chemicals such as paints, industrial chemicals or pesticides "borrowed" from industry for a job in the home, and garden chemicals. Exposure to and the ingestion of pesticides authorized for home garden use has seldom been accompanied by any toxic reactions. Similarly, there are few cases of poisoning related to the use or ingestion of domestic fumigants, wood preservatives, rodenticides, etc. "Borrowed" chemicals such as the herbicide paraquat may, on the other hand, present a real chemical hazard.

76-0667. Barnes, J. M. (Med. Res. Council, Toxicol. Unit, Carshalton, Surrey, England). **Assessing hazards from prolonged and repeated exposure to low doses of toxic substances.** *Br. Med. Bull.* 31(3): 196-200; 1975. (30 references)

Vitamins carry out an essential role in whole-body metabolism when present in food in only minute amounts. By analogy it has been suggested that other substances regularly present in traces might have detrimental effects. The level of safety of a toxic substance given in repeated doses may depend on its water solubility, rate of reaction in vivo, and the specificity and reversibility of any adverse reactions it brings about in the tissues. The effects of most organophosphorus (OP) inhibitors of cholinesterase are rapidly and totally reversible, but a few such compounds also produce a delayed damage involving the central and peripheral nervous systems. It is wise to avoid the use of any OP insecticide or plasticizer of this nature in any situation which might lead to food contamination. With persistent organochlorine compounds such as DDT and dieldrin, a steady state between absorption, storage, metabolism, and excretion is reached with a consistent daily intake. Related compounds (e.g., methoxychlor, endrin, and BHC) behave differently. Since DDT and dieldrin have no toxic activity while they remain in the fat and their toxic effects depend on the blood level, the ingestion of small amounts of these pesticides will have no adverse effects on health. In assessing the potential hazards from prolonged and repeated exposure to low doses of toxic substances, it should not be forgotten that the response of a sensitized person to some toxic compounds can be severe and progressive.

76-0668. Higgins, I. T. T. (Dep. Epidemiol., Sch. Pub. Health, Univ. Michigan, Ann Arbor, MI). **Importance of epidemiological studies relating to hazards of food and environment.** *Br. Med. Bull.* 31(3): 230-235; 1975. (24 references)

Much can be learned about the effects of exposure to chemicals from experiments in animals, but epidemiological surveys of exposure in man provide the soundest basis for assessing effects on human health and should be used whenever possible. The importance of epidemiological studies in determining the hazards presented by contaminants in food and the environment is reviewed with emphasis on dose-response relations in man and monitoring and surveillance. Illustrative examples are given of illness associated with gross contamination, illness associated with exposure to low concentrations of chemicals, water hardness associated with cardiovascular disease, environmental exposures and congenital malformations, and environmental exposures and associations with cancer. Epidemiological studies established the temporal and spatial distribution of Minamata disease in Japan, linked its occurrence with fish consumption, and eventually led to the correlation of the disease with its causative agent, alkylmercury, formed from the toxic waste of a chemical factory in the vicinity of Minamata Bay in Japan. Illness associated with exposure to low concentrations of chemicals is illustrated by an outbreak of methylmercury poisoning in Niigata, Japan. Studies are needed to explain the apparent nonexistence outside Japan of methylmercury poisoning related to fish consumption, despite the occurrence of apparently dangerous blood levels in other countries.

76-0669. Schafer, E. W., Jr.; Brunton, R. B.; Lockyer, N. F.; Cunningham, D. J. (U.S. Fish Wildlife Serv., Wildlife Res. Cent., Denver, CO). **The chronic toxicity of methiocarb to grackles, doves, and quail and reproductive effects in quail.** *Bull. Environ. Contam. Toxicol.* 14(6): 641-647; 1975. (7 references)

Methiocarb, a bird repellent, was fed in concentrations of 100-1,000 ppm to common grackles (*Quiscalus quiscula*), mourning doves (*Zenaida macroura*), and breeding pairs of coturnix quail (*Coturnix coturnix*) to study the possibility of cumulative intoxication in these species. Although aversion to the treated diets was readily apparent in most of the tests, the 28- to 30-day median lethal concentration (LC50) was greater than 100 ppm for the grackles, 630 ppm for the doves, and greater than 1,000 ppm for the coturnix quail. Methiocarb appeared to be noncumulative when measured by an index of chronicity: birds consumed several LD50 during a day's feeding, and when deaths occurred, they appeared to be due to acute intoxication. Egg production and live chick production were not affected in coturnix fed 100 ppm but were reduced at 316 and 1,000 ppm methiocarb. The results suggest that under field conditions it would be almost impossible for birds to consume lethal doses of methiocarb, even if minimal alternate food sources were available.

76-0670. Macek, K. J. (Fish-Pestic. Res. Lab., U.S. Fish Wildlife Serv., Columbia, MO 65201). **Acute toxicity of pesticide mixture to bluegills.** *Bull. Environ. Contam. Toxicol.* 14(6): 648-652; 1975. (12 references)

Bluegills (*Lepomis macrochirus*) were exposed under static conditions without aeration to varying concentrations of baytex, BHC, sevin, technical chlordane, copper sulfate, DDT, diazinon, dichlorvos, dieldrin, endosulfan, endrin, EPN, malathion, methoxychlor, methyl parathion, parathion, perthane, toxaphene, and/or zectran. Combinations of malathion with parathion, baytex, sevin, EPN, and perthane had greater than additive toxicity, as did parathion + diazinon, copper sulfate + parathion or sevin, parathion + methoxychlor, DDT + BHC, and methyl parathion + endrin. Similar results were obtained in rainbow trout (*Salmo gairdneri*). None of the other 17 combinations had more than additive toxicity, and malathion + copper sulfate had less than additive toxicity. These data indicate that further research on the interaction of pesticides in aquatic environments is urgently needed to protect fishery resources. Although none of the combinations which showed greater than additive toxicity to

bluegills is recommended for use in aquatic environments, safety precautions are warranted because compounds such as malathion and sevin may be used independently in or near aquatic sites.

76-0671. Lamberton, J. G.; Inman, R. D.; Claeys, R. R.; Robson, W. A.; Arscott, G. H. (Dep. Agric. Chem., Oregon State Univ., Corvallis, OR 97331). **The metabolism of *p,p'*-DDE in laying Japanese quail and their incubated eggs.** *Bull. Environ. Contam. Toxicol.* 14(6): 657-664; 1975. (21 references)

Seven-week-old male and female Japanese quail (*Coturnix c. japonica*) were fed a standard meal ration containing 100 ppm of *p,p'*-DDE. After 10 weeks on this diet, two hens with regular laying patterns were given a single oral dose of ^{14}C-DDE (145 μg) in corn oil. Eggs were collected after the birds reached 9 weeks of age and for 18 days following oral DDE administration. The DDE levels in the eggs, excrement, and tissues of the hens were determined by thin-layer and gas chromatography. No DDE metabolites, including 4,4-dichlorobenzophenone (DBP), were found in the eggs, tissues, or excrement of the quail hens. The DDE concentration in the eggs averaged 100 ppm wet weight, and the total amount of ^{14}C excreted in the eggs was 39.6% of the recovered activity. Between 0.43 and 1.58% of the recovered dose was found in the liver, between 0.009 and 0.007% of the recovered dose was found in the brain, and between 33.91 and 35.56% of the recovered dose was found in the carcass.

76-0672. Clark, R. P. (Pestic. Branch, U. S. Environ. Protect. Agency, Region IV, Atlanta, GA 30306). **Case-study of pesticide-related fish-kills in Alabama.** *Environ. Conserv.* 1(4): 309; 1974. (2 references)

When the use of DDT was cancelled by Administrative Determination and Order of the EPA on June 14, 1972, endrin was used as an alternative pesticide for the control of cotton pests at Lake Weiss in Cherokee County, Alabama. The acute oral LD50 of technical endrin to rats is 10 mg/kg, and the 48-hr EC50 to Bluegill (*Lepomis macrochirus*) is 0.3 ppb. An investigation of a reported fish-kill in Lake Weiss revealed endrin concentrations of 0.22-0.59 ppb; no other pesticides were detected. Because cotton in this area was planted quite close to the lakeshore, pesticide application by air or ground equipment would almost certainly result in contamination of the lake. Excessive rainfall during mid-August caused heavy run-off from the fields into the lake and undoubtedly also contributed to its pesticide contamination. The key to the prevention of similar incidences of pesticide contamination is the selective use of alternative and less persistent pesticides and proper education of the farmer.

76-0673. Huelse, M.; Federspil, P. (Hals-Nasen-Ohrenklinik, Univ. Saarlandes, Hamburg, Germany). **Gleichgewichtsstoerungen nach Insektizidvergiftung (Alkylphosphate). [Disturbance of equilibrium due to poisoning with organophosphate pesticides.]** *HNO* 23(6): 185-189; 1975. (21 references) (German)

Disturbance of the equilibrium was observed in a 41 year old gardener after handling mevinphos and dibrom. The acute poisoning symptoms, abdominal cramps, emesis, nausea, hypersecretion, cough, and perspiration, disappeared after 2 days, while anxiety, depression, vertigo, and spontaneous horizontal nystagmus persisted for 4 months. The findings indicate a central vestibular lesion. No loss of hearing or tinnitus were observed. On the basis of the literature review, the disturbance of equilibrium is regarded as a consequence of poisoning with the organophosphorus pesticide.

76-0674. Long, K. R. (Coll. Med., Inst. Agric. Environ. Health, Univ. Iowa, Oakdale, IA 52319). **Cholinesterase activity as a biological indicator of exposure to pesticides.** *Int. Arch. Occup. Environ. Health* 36(2): 75-86; 1975. (16 references)

The principles are discussed of biological testing, cholinesterase activity testing in relation to those principles, and the appropriateness of cholinesterase activity testing as an index of exposure under a variety of occupational environments involving pesticides. When considering cholinesterase activity testing as a biological indicator, several factors must be kept in mind. It must be known to what use the data from a given study is to be put. Data from cholinesterase activity measurements may be used to confirm the existence of organophosphorus poisoning or to measure a worker's individual and characteristic response. There are a variety of conditions associated with occupational exposure to pesticides which influence the choice of not only whether or not to use cholinesterase activity measurements as an exposure index, but also the choice of the method of measurement. Another contributing influence on the constancy and periodicity of exposure relates to worker behavior. Also, it is necessary to know the health status and physiologic relations of cholinesterase in an individual for both individual and group monitoring programs where cholinesterase activity is employed as a biological indicator. It is noted that, in general, prolonged or repeated exposures to inhibitors of cholinesterases have emphasized the unreliability of estimations of red cell, plasma, or serum activities, for judging the severity of intoxication. Where relatively constant exposures to an inhibitor are encountered, such as in the manufacturing and formulation steps, monthly or weekly assessments of a worker's cholinesterase activity is often satisfactory depending on the amount and physiologic activity of the inhibitor to which the individual is exposed. The greater the daily exposure, the more frequent the testing. For the best protection of workers, lab analyses should be done the same day and the results reviewed before commencement of work the following day. There are many test procedures available for testing cholinesterase enzyme activity, all of which are based on the ability of the enzyme to hydrolyze a given substrate.

76-0675. Kogure, M.; Imai, H. (Dep. Ophthalmol., Tokyo Women's Med. Coll., Tokyo, Japan). **Ocular symptoms induced by organic phosphorus insecticides.** *J. Am. Med. Women's Assoc.* 30(10): 420-422; 1975.

Organophosphorus use in Japan is higher than in any other country; these compounds are used not only as insecticides but are applied to vegetables before shipment to preserve their freshness. The organophosphorus insecticides are also used in ophthalmology; are therapeutic agents in the treatment of myasthenia gravis, glaucoma, squint, and amblyopia. Intentional or unintentional exposure to these chemicals can produce symptoms such as myopia, astigmatism, cataract, optic neuritis, diarrhea, perspiration, paralysis in the distal extremities, enhanced tendon reflexes, Babinski's reflex, clonus, loss of balance, adiadochocinesia, disturbances in prepriocceptive sensation, and symptoms of autonomic disorders. The visual disorders frequently encountered in the Saku District of Nagano Prefecture in Japan were found to be caused by chronic poisoning with organophosphorus agrochemicals. This disease occurred at a rate of 2/1,000 in the Saku District as compared with 17/10,000 throughout the rest of Japan. The prognosis of the disease is favorable if treated during the early stages, but optic atrophy and blindness may occur if discovery of the disease is delayed. Rigid controls should be applied to the use of organophosphorus compounds.

76-0676. Chini, V. (Clinica Medica dell'Universita di Bari, Bari, Italy). **Crisi di tachicardia ventricolare recidivanti in soggeto giovane con cardiomegalia, e iniziate dopo avvelenamento con anticrittogamici. Note acromegaliche. Miopatia cronica di imprecisata natura. [Attacks of recurrent ventricular tachycardia in a young subject with cardiomegaly, initiated after poisoning with fungicidal agents. Acromegalic manifestations. Chronic myopathy of undetermined nature.]** *Minerva Med. (Turin)* 64(37): 1965-1985; 1973. (Italian)

Three days after eating fruit sprayed with fungicides, a 14 year old youth was seized by attacks of ventricular tachycardia. These recurred even during hospitalization and following regression induced by electroshock treatment. Cardiomegaly of an imprecise nature was detected which had not manifested itself previously and which persisted unchanged even during periods of improvement. Acromegalic symptoms with signs of pelvirectal achalasia and megadolicho-sigma of an unexplained nature were noted. There were also muscular pains peculiar to histo-enzymatic investigations. Tachycardia persisted despite treatment with aymalin, cortisone, potassium, and bretylium tosylate. Electroshock therapy was repeated; at the third discharge of 200 Watt/sec, following the endovenous injection of 100 mg of bretylium tosylate, a sinusoidal rhythm was obtained which still persists. Improvement is progressive; extrasystoles appear erratically. There is no certain diagnosis. Cardiomegaly may or may not have existed prior to the poisoning. If it did, there may be connections with the acromegalic symptoms. The muscular alterations may or may not be late manifestations of the poisoning.

\$76-0677. Crockett, P. W. (Natl. Tech. Inform. Service, Springfield, VA 22161). **Toxic effects of pesticides (a bibliography with abstracts).** *Natl. Tech. Inform. Serv.* PS-75 009, 1975, 148 p. (148 references)

A bibliography is presented which includes abstracts on the toxic action of pesticides on non-target organisms. Studies on the biological effects on humans, wildlife, and aquatic life through direct exposure, food chain concentration, or degradation products are included. Research concerning the inhibition of cholinesterase and other enzymes is given special emphasis. The bibliography offers information on 148 references.

76-0678. Rodgers, D. P.; Crowder, J. P. (U.S. Dep. Interior, Bureau Sport Fisheries and Wildlife, Atlanta, GA 30329). **Threatened wildlife of south Florida.** *Natl. Tech. Inform. Serv.*, PB-231 654, 1974, 43 p.

This study considers on an individual basis several species of wildlife which are threatened by pesticides in southern Florida. There is evidence that reproduction of the Southern Bald Eagle has been curtailed due to the ingestion of pesticide-contaminated foods. Pesticide-induced fish kills near concentrations of eagles could be disastrous if heavy feeding on the carrion occurred. Current studies are underway concerning the effects of pesticides on this species. The Peregrine appears extremely susceptible to pesticide poisoning which reduces its capacity to reproduce. The decreasing number of the species and their wide dispersal may result in fewer pairings during nesting season. Attempts to curtail indiscriminate use of pesticides have been only partly successful. Stricter controls are essential if this species is to survive. Pesticide contaminated food has been determined to be the major cause of extirpation of the eastern Brown Pelican in Louisiana. Eggshells are about 9% thinner than normal in Florida pelicans, probably because of pesticides in the environment. Pesticides used in mosquito control are a potential threat to the Florida Great White Heron. Indiscriminate use of pesticides in and around residential areas has been harmful to the Cuban Yellow Warbler. The major problem for the American Osprey has been a decline in reproductive rate, thought to have been brought on by accumulations of residues of chlorinated hydrocarbon pesticides. The residues have been shown to be highest in food and eggs of ospreys in those populations in which the sharpest declines in reproductive success have been noted.

76-0679. Battelle Memorial Inst. (Richland, WA). **Program for the management of hazardous wastes. Vol. 1.** *Natl. Tech. Inform. Serv.* PB-233 630, 1974, 397 p. (397 references)

This report contains data, analysis, and rationale

that define and identify hazardous waste streams according to industry classification and by hazardous constituents. A priority ranking system is proposed which may be employed to develop a priority-of-concern list of hazardous wastes. Site-types are identified; process selection and design concepts are described. A breakdown of chlorinated hydrocarbon contaminated soil reveals a 30% organic composition (chlorinated hydrocarbons, haloorganic phosphorus, mercaptans, parathion insecticides, phenolics, phosphorus acids, sulfonated detergents, and urea). Inorganic contaminants of this soil-type include aluminum chloride, ammonium chloride, ammonium phosphate, calcium phosphate, calcium sulfate, carbonate, chloride, fluoride, nitrate, phosphate, sodium nitrate, sulfate, and sulfide. Arsenic contaminated soil includes lime, arsenic, oxide, arsenic chloride, mercury halide salts, some inorganic fluoride and chloride. Also presented in the study are system flow diagrams and various sub-systems (e.g., liquids-solids separation module, resource recovery, and effluent monitoring). Issues of transportation of hazardous wastes are described and detailed cost estimates for small, medium, and large site-types are developed.

76-0680. Nomura, S. (Sch. Public Health, Fac. Med., Kumamoto Univ., Kumamoto, Japan). [**Current occurrence of occupational dermal injury and problems for the future in Japan.**] *Nippon Saigai Igakkai Kaishi (J. Jpn. Accident Med. Assoc.)* 23(10): 489-496; 1975. (44 references) (Japanese)

The occurrence was described of skin injury due to occupational exposure to pesticides. Skin injuries due to pesticides included chloracne due to contact with pentachlorophenol and 2,4,5-T, and leucoderma due to contact with parathion. Potential problems of pesticide dermatitis include complex irritation due to mixed active ingredients and effects of solvents. The problems of polyvalent hypersensitivity and exposure to sunlight must be studied. The necessity of establishing standards for testing sensitivity to chemicals including pesticides was emphasized.

76-0681. Gallenga, G.; Fantozzi, R. (Servizio di Accettazione e Pronto Soccorso dell'Arcispedale di S. Maria Nuova, Firenze, Italy). **Intossicazioni acute: pronto soccorso e terapia d'urgenza.** [**Acute intoxications: first aid and emergency therapy.**] *Osp. Ital. Chir.* 26(6): 409-450; 1973. (57 references) (Italian)

Emergency first aid treatment for poison victims requires immediate removal of the toxic substance from the victim or from the vicinity of the victim, inactivation of poison with either an external or internal antidote when possible, and inducement of elimination mainly at the renal level. In cases of minor intoxications, gastric cleansing followed by administration of carbon and a saline purge, therapy for general care, elimination of the toxic substance by forced diuresis, or an observation period to detect any possible complications are recommended procedures. In serious cases, where respiratory and/or circulatory difficulties, state of shock, and coma are present, the victim will be treated with all necessary reanimation procedures (tracheotomy, automatic artificial respiration, monitoring of the patient, catheterization) and with constant and continuous control. Whenever possible, it is recommended to use internal antidotes associated with forced diuresis or with hemodialysis to rapidly improve cases of coma with respiratory and circulatory complications. Some of the more frequent causes of poisoning are presented.

76-0682. Apgar, W. (Pennsylvania Dep. Environ. Resour., Harrisburg, PA). **A review of pesticide related fish kills in Pennsylvania—1966-73.** *Pesticides Project, Dep. Environ. Resour., Harrisburg, PA*, 1975, 10 p.

A review was made of fish kills from pesticides during the years 1966 to 1973. A total of 40 pesticides related fish kills occurred during this period in Pennsylvania. Nearly all of the incidents occurred during the summer months with 32 of the 40 occurring between May 1 and August 31, a period coinciding with the time of the year of maximum utilization of these chemicals. Also at this time of the year low flow characteristics and reduced dissolved oxygen concentrations combine to place an initial stress on the fish population, making them more susceptible to toxic chemicals. Chester County leads the state with 6 kills, followed by Lancaster and Crawford Counties with 3 kills each. The average number of fish killed per incident was 4,526 with a median value of 622. Only two of the incidents were related to runoff. Eighteen were the result of careless application and handling of the chemicals and/or the improper utilization and maintenance of spray equipment. Only 25 of the incidents have known causes. Several of the incidents involve two pesticides. Organochlorine insecticides were responsible for most of the kills.

76-0683. Hurlbert, S. H. (Dep. Biol., San Diego State Univ., San Diego, CA). **Secondary effects of pesticides on aquatic ecosystems.** *Residue Rev.* 57: 81-148; 1975. (100 references)

Among the most commonly reported secondary effects in aquatic ecosystems are blooms of phytoplankton following insecticide—or piscicide—caused mortality of zooplankton and attending decomposition of herbicide-killed aquatic macrophytes; increased abundance of macroscopic filamentous algae following insecticide-caused mortality of herbivorous insects; reduction of invertebrate populations dependent on aquatic vegetation as a physical substrate or hiding place, increased populations of benthic detritus-feeders, and increased abundance of *Chara* and filamentous algae following destruction of aquatic vascular plants with herbicides; increased abundance of certain invertebrates following insecticide or piscicide-induced mortality of fish or predaceous invertebrates; increased abundance of certain invertebrates following reduction of

populations of their competitors, and increased abundance of invertebrate predators that can utilize the replacing species; increased growth rates for surviving individuals in food-limited populations whose densities are lowered by pesticide-caused mortality of a predator that preyed preferentially on these other species; changes in oxygen, carbon dioxide, bicarbonate ion, calcium, and other chemical variables as a function of changes in phytoplankton and macrophyte populations; and reduction in turbidity following removal of carp populations with piscicides. These phenomena have been documented principally in experiments on the effects of discrete applications of specific pesticides. There is no clear information on the kinds and magnitudes of secondary effects occurring in large-scale, often regional or even world-wide, aquatic systems which are receiving continuous influxes of a variety of pesticides and other pollutants. (Author abstract by permission, abridged)

76-0684. Weiss, B.; Doherty, R. A. (Environ. Health Sci. Cent., Univ. Rochester Sch. Med. Dent., Rochester, NY 14642). **Methylmercury poisoning.** *Teratology* 12(3): 311-314; 1975. (3 references)

Methylmercury is the most toxic compound of mercury, its toxic properties producing sensory malfunctions, motor manifestations, a variety of nonspecific symptoms, and impaired behavioral development and severe brain damage in fetuses and neonates. Toxic exposure to methylmercury occurs primarily via the consumption of contaminated fish or bread prepared from methylmercury-treated seed wheat. Methylmercury also passes freely from mother to fetus, and infants may be exposed by consumption of contaminated mothers' milk. If neurologic criteria are consistent, the only way to definitively confirm a diagnosis of methylmercury poisoning is to establish exposure, particularly by chemical assay. No totally satisfactory method of treatment has yet been established, and methylmercury poisoning can be prevented only by insuring that the contaminant does not enter food supplies. Thus, methylmercury should no longer be used as a fungicide and the industrial discharge of mercury into the environment should be halted.

76-0685. Osweiler, G. D. (Dep. Anat. Physiol., Univ. Missouri, Sch. Vet. Med., Columbia, MO). **Sources and incidence of small animal poisoning.** *Vet. Clin. N. Am.* 5(4): 589-604; 1975. (12 references)

The following guidelines in approaching animal poisoning cases are suggested: institute emergency and supportive therapy necessary to maintain life; establish a tentative clinical diagnosis to base therapy; institute appropriate remedial and antidotal procedures; obtain confirmation of the chemical agent responsible; determine the source of toxicant; educate the client to the hazards of such toxicants and instruct him how to avoid recurrences of the experience. Toxins may be grouped into natural hazards and man-made hazards. Among the man-made hazards, pesticides are frequent offenders. When such a man-made chemical is suspected, the following steps are to be taken: attempt to secure a label or container from the product used; determine the active ingredient either from reference tools or from a poison control center; if the specific toxicant is not identifiable, determine the most likely active ingredients and the relative toxicities of each; compare the signs of toxicity exhibited by the patient with those which would appear on ingestion of these toxicants; after limiting the clinical and exposure possibilities as much as possible, confirm the toxic principle chemically in tissues, fluids, or ingesta from the animal.

76-0686. Harris, W. F. (Puyallup, WA). **Clinical toxicities of dogs.** *Vet. Clin. N. Am.* 5(4): 605-622; 1975. (7 references)

The ingestion of baits intended for predators and rodents by dogs has resulted in numerous accidental cases of strychnine poisoning. Strychnine is also used in malicious efforts to destroy dogs. Commercially prepared baits often contain 300 to 500 mg which is 6 to 10 times the toxic dose for a dog. Earliest signs of toxicity may appear from 15 min to 2 hr after ingestion. Apprehensiveness appears to be the first observable change, with nervousness and restlessness followed by increased muscle rigidity and tetanus-like convulsions progressing to respiratory failure and death from anoxia. Although principally a spinal cord stimulant, strychnine is a stimulant to the entire nervous system, central as well as peripheral. Treatment must be directed toward overcoming the violent signs and reducing further absorption from the digestive tract. Barbiturates or gas anesthesia will overcome the convulsions and permit gastric lavage with a dilute solution of tannic acid or potassium permanganate. In some places in the country, metaldehyde poisoning due to ingestion of slug and snail baits runs a close second to strychnine. A minimum toxic dose is between 0.2 and 0.4 gm/kg body weight. Due to its inclusion with metaldehyde in certain slug and snail baits and because it has a variety of other agricultural and garden uses that expose the dog to the possibility of poisoning, arsenic is among the more common offenders in the list of toxicants to the dog. Several commercial herbicides depend on sodium aresenite for their effectiveness. Such weed killers are very slow to be biodegraded by leaching away in the soil and some have an appealing taste. Warfarin and pindone, two most important anticoagulant drugs, are in widespread use as rodenticides. They are used in final concentrations of 0.025% in grains, meals, or other foods attractive to rodents. They inhibit prothrombin formation leading to delayed clotting time and weakened capillaries. Carbamates are used against a number of arthropods and insects on plants and animals. Carbaryl is extensively used on dogs and is of low toxicity, but may have teratogenic effects. Among the cholinesterase-inhibiting chemicals used on dogs the most common belong to the organophosphate group. DDVP, trichlorfon, dimethoate, and malathion are notable examples of aliphatic organic phosphorus compounds, whereas ronnel,

ruelene, and parathion are examples of the cyclic group. With the thousands of pounds of chlorinated hydrocarbon compounds on and around livestock and agricultural crops, it is inevitable that canine poisoning accidents will occur. Herbicides and fungicides other than arsenical compounds, although widely distributed in a dog's environment, generally lack palatability or appeal and low concentrations at the point of dog contact make poisoning due to these chemicals uncommon. The rodenticide, alphanaphthyl thiourea, is a potential hazard to the canine population only in certain areas of the country as it is prohibited in several states. Thallium sulfate, the salt in most common use as a rodenticide, is less toxic than thallium acetate.

76-0687. Atkins, C. E.; Johnson, R. K. (Valley Vet. Hosp., Walnut Creek, CA). **Clinical toxicities of cats.** *Vet. Clin. N. Am.* 5(4): 623-652; 1975. (85 references)

The amount of information on feline toxicology is sparse. Much has been concluded from a few clinical cases, from experimental work, and by extrapolating information from other species. Cats are said to be quite sensitive to benzyl benzoate, a miticide, and should not be subjected to it. Rotenone, derived form the derris plant and used as an insecticide, is considered relatively nontoxic, will occasionally cause nausea and vomiting in cats, and produces liver damage in cats ingesting it from their fur. Chlorinated hydrocarbons known to be toxic to cats are DDT, TDE, methoxychlor, lindane, chlordane, toxaphane, dieldrin, aldrin, and endrin. The cat is poisoned by walking or lying on contaminated surfaces or by topically applied pesticides in which the toxin is ingested with subsequent grooming. They can also be absorbed through the skin and ingested in poisoned insects. The oral minimum lethal dose for DDT is about 250 mg/lb. For endrin the oral lethal dose is 3 to 6 mg/kg; aldrin, 15 mg/kg; dieldrin, 500 mg/kg. For cutaneously applied endrin it is 150 mg/kg; aldrin, 75 mg/kg; dieldrin, 750 mg/kg. These compounds act on the central nervous system and chronically cause both hepatic and renal degeneration. They are stored in fat, excreted in milk, cross the placenta and remain for long periods as residues in soil. Members of the organophosphate group include ronnel, Co-ral, malathion, parathion, dichlorvos, tetraethyl pyrophosphate, dioxathion, trichlorfon, ruelene, dicapton, diazinon, and fenthion. This group produces its effect by completely inhibiting acetylcholinesterase, thus allowing acetylcholine to exist in excess. The carbamates used in insecticides for plants and animals are relatively nontoxic. Arsenic poisoning may arise from its use in ant poisons, herbicides, snail bait, and insecticides. The use of strychnine may also result in poisoning, when used as a pesticide or in malicious poisonings. Metaldehyde, used in snail bait, has not been reported as poisonous to the cat. However, the cat is quite susceptible to the rodenticides sodium fluoracetate and fluoracetamide which are colorless, odorless, and tasteless. ANTU (alpha naphthyl thiourea) is an odorless, bitter-tasting, bluish-gray powder used as a rodenticide which has an LD50 for the cat of 75 to 100 mg/kg. Thallium has poisoned cats either by direct ingestion or by ingesting poisoned rodents. Warfarin, pindone, and diphacinone are all anticoagulants, which inhibit prothrombin synthesis by interfering with the action of vitamin K. Zinc phosphide, a commonly used rodenticide, produces anorexia, colic, lethargy, coma, and asphyxiation. Alpha chloralose, used both as a rodenticide and an anesthetic agent in rodents, acts both by depressing and stimulating the central nervous system. The cat has been used to study methylmercury toxicity as this species manifests similar clinical and pathological features to those of man. The cat would appear to be a useful sentry to potential dangers to man from environmental mercury.

76-0688. Feldman, B. F.; Kruckenberg, S. M. (Coll. Vet. Med., Kansas State Univ., Manhattan, KS). **Clinical toxicities of domestic and wild caged birds.** *Vet. Clin. N. Am.* 5(4): 653-673; 1975. (40 references)

For caged domestic birds, strychnine saturated, plain canary seed, used to poison mice, appears as a readily available and attractive source of food. Arsenic, used as an ant poison, herbicide, insecticide, and mouse and rat bait is also accessible to birds. Lead salts present in insecticides are also linked to bird poisonings. Lead compounds and arsenic compounds are used as insecticides and herbicides. Birds affected by household spray insecticides containing chlorinated hydrocarbons became ill about 48 hr after initial usage. Organic phosphorus compounds have caused muscle tremors. In cases of caged wild birds, pesticide contamination of the natural environment of these birds heads the list. Halogenated hydrocarbon insecticides such as DDT are potent stimulators of drug and steroid sex hormone metabolism in mammals and in birds. The breakdown of sex hormones may explain in part the devastating effect of DDT on reproduction in some bird populations. Actidione or cyclohexamide, a fungicide, causes goose-stepping, ataxia, polydipsia, wing drop or wings crossed high over the back, wing shivers, periodic falling, and prostration in mallards. Chlordane, 2,4-D, DDVP, gophacide, heptachlor, lindane, malathion, nicotine sulfate, rotenone, sevin, sodium arsenate, sodium monofluoracetate, and strychnine all produce toxicity in wild birds. Mercurials used as fungicides and seed disinfectants caused ataxia, ataraxia, low carriage, hunching up with feathers, wing drop, neck pulled in, blinking, dyspnea, and immobility. Representative data related to food consumption and body weights of differerent species and ages of birds is needed.

76-0689. Kruckenberg, S. M.; Cook, J. E.; Feldman, B. F. (Dep. Pathol., Coll. Vet. Med., Kansas State Univ., Manhattan, KS). **Clinical toxicities of pet and caged rodents and rabbits.** *Vet. Clin. N. Am.* 5(4): 675-684; 1975.

This article presents experiences with unintentional poisoning in rodents and lagomorphs. Greens contaminated with pesticide or insecticide mixtures are a

common source of poisoning. The most common types of poisoning seen are caused by organophosphates and carbamates. These are cholinesterase inhibitors, and typical signs can be observed. Chlorinated hydrocarbon poisoning from contaminated greens is not seen very frequently because of the curtailment of the use of these chemicals in the food produced for human or animal consumption. One common problem is the ingestion of baits containing anticoagulants such as warfarin. The ingestion occurs when the pet is released to play in an area where there are baits for wild rodents. This is especially true in basements and other areas that may have mice and rats invading. Treatment with vitamin K_1 should be administered prophylactically. A clotting time may be of value in assessing the success of this treatment. If the drug is given before the onset of bleeding, the animal may survive. Arsenic has been used as an insecticide and rodent bait for some time and occasionally a pet rodent or rabbit may ingest arsenic and die. However, this is no longer common in pets.

76-0690. Fowler, M. E. (Sch. Vet. Med., Univ. California, Davis, CA). **Toxicities in exotic and zoo animals.** *Vet. Clin. N. Am.* 5(4): 685-698; 1975. (8 references)

The object of this article is to provide veterinarians with an overview of the potential poisoning of wildlife in relation to environment. Toxic substances can produce different syndromes in different species of animals. Wild animals have the highly developed ability to mask clinical signs until disease has progressed to near termination. Clinical examination of wild species is also more difficult as some of the vital signs commonly referred to such as temperature, pulse rate, heart rate, respiratory rate, and others are difficult to obtain and may be meaningless as they are altered by excitement associated with the restraint and handling necessary to obtain the information. The acquisition of an accurate history is the best key to the diagnosis of clinical toxicity in wild animals. A common hazard for zoo animals is the use of rodenticides to prevent a buildup of rats and mice which spread disease from cage to cage. Careless placement of baits can result in poisoning of collection animals. Warfarin and sodium fluoroacetate are common hazards. In poisonings with the first compound, the most effective treatment is whole blood transfusions, which may be impossible in zoo animals. Alternatively, administer vitamin K or menadione. For poisonings with sodium fluoroacetate, treatment is usually of little avail due to the rapidity with which the poison affects the animal. Chemicals used to control pigeons are also toxic to other seed-eating birds and possibly to mammals. Extreme caution must be used lest the bait be placed where nontarget species may eat it. In investigating the death of a zoo animal, one should thoroughly check the area for the presence of baited grain, such as whole kernel grain or pellets. All water for drinking in animal compounds should be replaced following spraying of insecticides. Wild species are affected by insecticides. The indiscriminate use of such chemicals may virtually destroy one step in a food chain, affecting all species higher on the ladder.

76-0691. Schuchman, S. M.; Frey, F. L.; Barrett, R. P. (Boulevard Pet Hosp., Castro Valley, CA). **Toxicities and hazards for clinicians in small animal practice.** *Vet. Clin. N. Am.* 5(4): 727-735; 1975.

Health hazards and potential toxicities which surround the clinician in his work are considered. A small animal clinician has at his disposal a relatively large number of inert, gas-propelled, aerosol products which includes flea and tick parasiticides. Proper instruction in the use, storage, and disposal of ectoparasiticides should be given all professional and lay help. Signs stressing the wearing of proper protective clothing while giving insecticide baths should be posted around kennel and tub areas. Absorption of organophosphate chemicals via the skin is a major route of intoxication. The original labeling should be kept on all containers. If it is necessary to use additional, different containers, labeling close to that on the original containers should be put on all subsequently used containers. Disposal of used containers should include water flushing of container, then disposal by proper incineration or dumping in authorized land fill areas. When insecticide is spilled on the floor, a thorough soap and water washing should be performed. Sawdust absorbents can be used first, but these necessitate proper disposal.

76-0692. Bailey, E. M. (Dep. Vet. Physiol. Pharmacol., Coll. Vet. Med., Texas A & M Univ., College Station, TX). **Emergency procedures in intoxications.** *Vet. Clin. N. Am.* 5(4): 737-753; 1975. (3 references)

In treating animals suffering from intoxicant ingestion, the main goal is to preserve life. Specific steps include the emergency intervention and prevention of further exposure, delaying further absorption, application of specific antidotes, hastening elimination of the toxicant, and offering supportive therapy. The most important aspect of emergency treatment of intoxications is to insure adequate physiologic function. This may require establishing a patent airway, artificial respiration, cardiac massage, and perhaps the application of defibrillation techniques. Absorption may be delayed by the induction of emesis, gastric lavage, adsorbents, and cathartics. Although there is a paucity of specific antidotal agents, there are a few available and should be used if appropriate. The elimination of absorbed toxicants is usually through the kidneys. Such excretion can be enhanced by using diuretics or altering the pH of the urine. Supportive measures include body temperature control, respiratory support measures, and cardiovascular support including acid-base imbalance control. The control of pain is also important. It is stressed that the information available at the poison control centers and diagnostic laboratories is of great value to the clinician in treating animals with suspected intoxications.

76-0693. Sutherland, G. D. (Launceston, Cornwall, England). **Toxic effects of preserved timber.** *Vet. Rec.* 95(24): 556; 1974.

In a Letter-to-the-Editor, veterinarians are asked to report any instances of adverse effects in cows or horses that have licked or chewed preserved timber. Tanalized timber has been treated with a preserving solution containing copper sulfate, potassium dichromate, and arsenious acid, all of which are toxic. Cases of animal injury due to treated timber have recently been reported form Sweden and Ireland, but no information was yet available from the United Kingdom.

76-0694. Daykin, J. M. (Lewes, England). **Mercury poisoning.** *Vet. Rec.* 96(11): 255-256; 1975.

Three cows died as a result of mercury poisoning. One animal observed in extremis presented with symptoms similar to anthrax, i.e., weakness, recumbency, bloody nasal discharge, and pronounced submucosal hemorrhages of all mucous membranes, and melena. However, the condition was afebrile and profound anemia was also present. The suspected source of the mercury was dressed seed wheat being fed in the production ration, but further extensive investigation is being carried out by the veterinary investigation service at Wye and Weybridge. It is hoped that this report will emphasize the danger of feeding dressed seed corn to domestic farm animals with the attendant public health risks of mercury residues in the meat and milk.

76-0695. Stevenson, D. E.; Carter, B. I. (Shell Res. Ltd., Tunstall Lab., Sittingbourne Res. Cent., Sittingbourne, Kent, England). **Pesticides and domestic animals.** *Vet. Rec.* 97(9): 164-169; 1975. (21 references)

Although all pesticides in the United Kingdom must be registered under the Pesticide Safety Precautions Scheme (PSPS) and/or the Agricultural Chemicals Approval Scheme (ACAS) and recommendations and restrictions for use are printed on the labels, domestic animals are quite often poisoned by pesticides. The vast majority of poisoning cases are caused by carelessness or deliberate misuse in the form of baiting. The latter is often illegal but may be difficult to prove. Cases of suspected poisoning must be treated as urgent until the actual situation is assessed. Since specific antidotes are the exception, time taken to search for one may be wasted. Immediate symptomatic therapy should be instituted and care taken to maintain a free respiratory passage. It may be possible to reduce contamination by washing the fur or eyes. Toxic pesticides may be broadly classified as causing cholinesterase inhibition, central nervous system stimulation, gastroenteritis, methemoglobinemia, or other symptoms. Compounds which produce these symptoms and means of treating them are recommended. Advice relating to the diagnosis or treatment of poisoning is available from several sources including the manufacturer and the Veterinary Investigation Service. Laboratory confirmation of poisoning and the legal aspects of domestic animal poisoning by pesticides are discussed.

See also **76-0604** **76-0605** **76-0606** **76-0614** **76-0622** **76-0624** **76-0625** **76-0790**

76-0696. Hennighausen, G.; Tiefenbach, B.; Dietrich, C. (Inst. Pharmakol. Toxikol., Univ. Rostock, Rostock, DDR). **Untersuchungen ueber toxikologische und pharmakologische Eigenschaften von Chlorcholinchlorid und *N,N*-Dimethyl-(2-bromaethyl)- hydraziniumbromid.** [**Studies on toxicological and pharmacological properties of chlorcholine chloride (CCC) and *N,N*-dimethyl-(2-bromoethyl)-hydrazinium bromide (BMH).**] *Acta Biol. Med. Ger.* 33(1): 89-98; 1974. (9 references) (German)

The acute toxicity of chlormequat chloride (CCC) and *N,N*-dimethyl- (2-bromoethyl)-hydrazinium bromide (BMH) was studied in mice and Wistar rats. The acute i.v. LD50 of CCC was found to be 7 mg/kg in mice, 12.5 mg/kg in rats, against 62-68 mg/kg in mice and 52-66 mg/kg in rats after i.p. application, and against 460 mg/kg in male mice, 580 mg/kg in female mice, and 560 mg/kg in rats after oral application. The acute LD50 of BMH was 72 mg/kg in mice and 60 mg/kg in rats after i.v. application; 315 mg/kg in mice and 250-300 mg/kg in rats after i.v. application, and 3,100 mg/kg in male mice, 1,600 mg/kg in female mice, and 3,200 mg/kg in rats after oral application. The data indicate the consistently lower toxicity of BMH, and the reduced enteral resorption. While small and fractionated doses of atropine reduced the toxicity of CCC and BMH, doses of 50 mg/kg and over increased the mortality. Model experiments showed that the action on the respiratory system are of decisive importance for the acute toxicity of CCC and BMH. The respiratory failure in acute poisoning is found to be due to the neuromuscular blocking action of CCC. The muscarinergic effects of these compounds influence the acute toxicity to a low degree only. In i.v. doses of 0.05-5 mg/kg and 0.1-20 mg/kg, respectively, CCC and BMH caused hypotension by up to 30-40%. It was possible to restore spontaneous respiration in seriously poisoned animals by artificial respiration.

76-0697. Lange, P.; Wiezorek, W. D. (Inst. Pharmacol. Toxicol., Univ. Humboldt, Berlin, Germany). **Effects of diethyldithiocarbamate on acute toxicity and acetylcholinesterase inhibition by methylparathion in mice.** *Acta Biol. Med. Ger.* 34(3): 427-433; 1975. (14 references) (German)

The acute toxicity of methyl parathion in male mice was reduced by diethyldithiocarbamate (DET) in doses ranging from 50 to 300 mg/kg. The mean survival time in the LD_{100} range of methylparathion was significantly prolonged. Inhibition of AChE in vivo was also reduced. The dose effect relation showed an approximately 10-fold increase in equi-effective doses after pretreatment with DET. No protective effect, either in vivo or in vitro, was attributed to DET when methylparathion was added to the brain homogenate of mice. It is suggested that DET changes methylparathion metabolism by its influence on the system of mixed function oxidases.

76-0698. Mann, S. K.; Brat, S. V.; Mhach, S. (Dep. Bot., Panjab Univ., Chandigarh, India). **Effect of maleic hydrazide on mitosis.** *Acta Bot. Indica* 2(1): 44-48; 1975. (7 references)

Maleic hydrazide solutions of 10 ppm and 20 ppm concentrations were used to treat intact 1-3 cm long roots from onion bulbs for 2, 4, and 6 hr followed by recovery periods up to 24, 48, and 72 hr. Mitotic aberrations induced by maleic hydrazide comprised chromosome breakage and inhibition of spindle formation. The chromosome breakage occurred during synthetic as well as post synthetic periods of mitosis. The breakage was frequent either in the regions of the centromeres or their vicinity. Besides small gaps and lesions, chromatid breaks and sister chromatid exchange was also noted. The frequency of breakage in barley was lower than the one for onion. However, in the case of onion, a marked chromosome condensation was noted. Apparently the two plants react in different ways because of the differences in their genotypic constitution. In some cells of onion, the formation of structures like pseudochiasmata were noted when the onion was allowed to undergo a period of recovery of 24 hr and the barley material treated for 6 hr. It was observed that maleic hydrazide affected spindle particularly when it was used at 10 ppm concentrations for 4 to 6 hr, and at 20 ppm for 2 hr. Since the mode of action of maleic hydrazide involved interference with RNA molecules, it is suggested that it perhaps reacts with sulfhydryl groups and reduces the synthesis of those enzymes in which SH groups are required. Thus, it might also affect S-H and S-S linkages in the same manner as do morphactins.

76-0699. Hettwer, H. (Inst. Aerobiol., Fraunhofer-Gesellschaft, Grafschaft/Sauerland, Germany). **Histochemische Untersuchungen an Leber und Niere der Ratte nach Phosphorsaeurevergiftung.** [**Histochemical investigations on liver and kidney of the rat after intoxication with organophosphates.**] *Acta Histochem.* 52: 239-252; 1975. (35 references) (German)

The effect of soman and paraoxon (administered i.p. in doses of 0.18 mg/kg and 0.9 mg/kg, respectively), and of experimental hypoxia and starvation for 24-36 hr was studied on the liver and kidney of female Sprague-Dawley rats. Unlike starvation, poisoning with soman and paraoxon or experimental hypoxia caused fat phanerosis in renal and hepatic tissues, especially in the centers of the lobules. The fatty degeneration was most intense after poisoning with soman. The fatty degeneration was manifest as soon as 1 to 3 hr after poisoning in the liver, but it appeared in the kidney 24 hr later. Fat phanerosis was observed over 48 hr after poisoning. There was no difference in the neutral fat and glycerin content in the sera of normal and poisoned animals. No reduction in the phosphatid formation, which might be indicative of cholin deficit, was observed. The findings indicate that the fatty degeneration of the liver and kidney after poisoning with organophosphorus compounds is due to intracellular hypoxia. Poisoning caused no marked change in the cytochrome oxidase, malate, isocitrate, α-ketoglutaric acid, lactate, and glucose-6-phosphate dehydrogenase, β-hydroxybutyric acid dehydrogenase, lipase, or unspecific esterase activities, but caused slight to moderate

changes in the acid phosphatase, succinate dehydrogenase, pyruvate dehydrogenase, and NADH-tetrazolium reductase activities.

76-0700. Verzarne Petri, G.; Vinczene Vermes, M.; Horvath, L.; Balintne Ambro, I.; Szarvas, T. (Inst. Herbol. Pharmacol., Semmelweiss Med. Univ., Budapest, Hungary). **6-14C-Vitavax beepulese es hatasa a *Datura innoxia* Mill. ipari gyogynovenyunkre. [The uptake of 6-14C-Vitavax and its effect on *Datura innoxia* Mill., an industrial and medicinal plant.]** *Acta Pharm. Hung.* 45(4): 167-174; 1975. (6 references) (Hungarian)

Uptake of vitavax (carboxin) in *Datura innoxia* Mill. was studied autoradiographically. Seeding plants grown from Vitavax-dressed seeds incorporated 0.4% of the radioactivity, and their alkaloid level was about the same as that of control plants. The rate of incorporation after root incubation of seedling plants for 24 hr and 5 days was 2.3% and 7%, respectively, and incorporation of radioactivity in the alkaloids was observed after 24 hr incubation. This incorporation is due to the splitting of the molecule at the labeled site, and to the subsequent incorporation of an acetate unit in the tropane structure. The incorporation of radioactivity in the alkaloids caused a reduction of the total alkaloid content, and Vitavax metabolites were also found. Autoradiographic examinations of roots, stems and leaves of fully developed plants after incubation for 24 hr suggest the rapid translocation and secretion of vitavax. Vitavax residues were present in plants grown from Vitavax-dressed seeds for up to 2 months.

76-0701. Jordan, L. S.; Zurqiyah, A. A.; Clerx, W. A.; Leasch, J. G. (Dep. Plant Sci. Univ. California, Riverside, CA 92502). **Metabolism of terbacil in orange seedlings.** *Arch. Environ. Contam. Toxicol.* 3(3): 268-277; 1975. (9 references)

Orange seedlings were cultured in aqueous solutions of 3-*tert*-butyl- 5-chloro-6-methyluracil (terbacil and terabacil-2-^{14}C). Radioactivity was distributed throughout the plant with the largest amount in the roots and the smallest amount in the leaves. Terbacil was metabolized to form 3-*tert*-butyl-5-chloro-6-hydroxymethyl uracil, which was conjugated to form a β-glucoside as the conjugate was hydrolyzed by β-glucosidase. Identification of the metabolite was made by infrared and mass spectrometry after isolation and purification by column and thin layer chromatography. An additional unidentified water-soluble material was accumulated in the plant. 5-Chloro-uracil was not detected as a metabolite of terbacil. (Author abstract by permission)

76-0702. Greichus, Y. A.; Call, D. J.; Ammann, B. M.; Greichus, A.; Shave, H. (Exp. Stn. Biochem. Dep., South Dakota State Univ., Brookings, SD 57006). **Physiological effects of polychlorinated biphenyls or a combination of DDT, DDD, and DDE in penned white pelicans.** *Arch. Environ. Contam. Toxicol.* 3(3): 330-343; 1975. (33 references)

The effects of PCBs (polychlorinated biphenyls) or a combination of DDT (1,1,1-trichloro-2,2-bis (*p*-chlorophenyl) ethane), DDD (1,1-dichloro-2,2-bis (*p*-chlorophenyl) ethane), and DDE (l,l-dichloro-2,2-bis (*p*-chlorophenyl ethylene) on organ weights, liver storage of vitamin A and carotene, selected blood chemistry parameters, and serum protein fractions were determined in penned white pelicans (*Pelecanus erythrorhynchos*) receiving a daily dosage of these compounds. Birds received 100 mg of PCBs or a combination of DDT (20 mg), DDD (15 mg), and DDE (15 mg) injected into the first fish fed each day for ten weeks. A greater percentage of PCB treatment was retained in brain, liver, carcass, and feathers than the percentage of DDT + DDD + DDE treatment. Liver weight as percent of body weight decreased ($p < 0.01$) in DDT + DDD + DDE-treated birds and increased ($p < 0.01$) as a total weight in PCB-treated birds. Spleen weight as percent of body weight was greater ($p < 0.05$) in PCB-treated birds. Neither treatment had a significant effect on the weight of the brain, heart, or kidney. Liver vitamin A levels were greater ($p < 0.01$) on a μg/g of liver basis in the DDT-treated birds than in controls. Significant lowering of serum potassium and protein values was noted in both the PCB- and the combination of DDT, DDD, DDE-treated birds, while serum calcium values were lowered ($p < 0.01$) only in PCB-treated birds. Values of serum inorganic phosphorus, uric acid and magnesium were not significantly changed by either treatment. Globulin fractions were unaltered by either treatment, but albumin fractions were lowered ($p < 0.01$) in the PCB-treated pelicans. (Author abstract by permission)

76-0703. Tagatz, M. E.; Borthwick, P. W.; Forester, J. (Environ. Protect. Agency, Gulf Breeze Environ. Res. Lab., Gulf Breeze, FL 32561). **Seasonal effects of leached mirex on selected estuarine animals.** *Arch. Environ. Contam. Toxicol.* 3(3): 371-383; 1975. (15 references)

Four 28-day seasonal experiments were conducted using selected estuarine animals in outdoor tanks that received continuous flow of mirex-laden water. Mirex (dodecachlorooctahydro-1,3,4-metheno-2*H*-cyclobuta [*cd*] pentalene) leached from fire ant bait (0.3% mirex) by fresh water and then mixed with salt water was toxic to blue crabs (*Callinectes sapidus*), pink shrimp (*Penaeus duorarum*), and grass shrimp (*Palaemonetes pugio*) but not to sheepshead minnows (*Cyprinodon variegatus*), at concentrations less than 0.53 μg/l in water. The amount of leaching was greatest in summer and least in spring. Greatest mortality occurred in summer at the highest water temperature and concentration of mirex; least mortality occurred in spring at next to the lowest temperature and at the lowest concentration. Earliest deaths of blue crabs occurred after six days of exposure and shrimps after two days. Small juvenile crabs were more sensitive to leached mirex than were large juveniles. Mirex did not appear to affect growth or frequency of molting in crabs.

All exposed animals concentrated mirex. Among animals that survived for 28 days, sheepshead minnows concentrated mirex 40,800× above the concentration in the water, blue crabs 2,300×, pink shrimp 10,000×, and grass shrimp 10,800×. Sand substrata contained mirex up to 770× that in the water. Most control and exposed animals in samples examined histologically had normal tissues, but alteration in gills of some exposed fish and natural pathogens in some exposed and control crabs and shrimp were observed. The experiments demonstrated that mirex can be leached from bait by fresh water, concentrated by estuarine organisms, and can be toxic to crabs and shrimps. (Author abstract by permission)

76-0704. Caldwell, P. T.; Ren, P.; Bell, R. G. (Biochem. Dep., Univ. Rhode Island, Kingston, RI 02811). **Warfarin and metabolism of vitamin-K.** *Biochem. Pharmacol.* 23(24): 3353-3362; 1974. (21 references)

To further examine the hypothesis that warfarin inhibits prothrombin synthesis by interfering with the cyclic interconversion of vitamin K_1 and phylloquinone epoxide, the metabolism of tracer doses of labeled vitamin K_1 was studied in anticoagulant-treated rats. A tracer dose of $[^3H]K_1$ initially turned over with a half-life of 2.2 hr in the liver, but after 5 hr the degradation rate decreased considerably. Warfarin caused hepatic $[^3H]K_1$ levels to drop to 50 per cent of controls 5 min after administration of the vitamin, and over 10 hr the concentration of $[^3H]K_1$ was 26-36 per cent of control levels. This decrease in vitamin K_1 was not large enough to account for the inhibition of prothrombin synthesis by warfarin. Thirty-five min after warfarin administration, there was more $[^3H]$phylloquinone epoxide in the liver than labeled vitamin and over 10 hr the $[^3H]$ epoxide $[^3H]K_1$ ratio varied from 1:6 to 3:0. In addition to increasing the relative amount of $[^3H]$epoxide, warfarin and phenylindanedione also increased hepatic metabolites more polar than vitamin K_1 or epoxide. However, warfarin did not increase plasma or urinary radioactivity. The urine was the principal excretory route for metabolites of vitamin K_1. 2-Diethylaminoethyl-2,2,diphenylvalerate hydrochloride (SKF 525-A) inhibited the turnover of $[^3H]K_1$ but did not decrease the $[^3H]$ polar metabolites in the liver in control or warfarin-treated rats. (Author abstract by permission, abridged)

76-0705. McPherson, F. J.; Bridges, J. W.; Parke, D. V. (Dep. Biochem., Univ. Surrey, Guilford, England). **The enhancement of biphenyl 2-hydroxylation by carcinogens in vitro.** *Biochem. Soc. Trans.* 2(4): 618-619; 1975. (4 references)

Hepatic microsomal preparations from adult male Syrian hamsters or adult male Wistar rats were added to a regenerating system containing glucose 6-phosphate, glycose 6-phosphate dehydrogenase, and one of a variety of carcinogens or noncarcinogens. After 5 min incubation, biphenyl was added and the incubation continued for 5 more min. A number of carcinogens, including butter yellow, dimethylnitrosamine, aflatoxin B_1, 3-methylcholanthrene, 2-acetamidofluorene, and safrole produced a significant elevation in biphenyl 2-hydroxylation but had no effect on or slightly inhibited biphenyl 4-hydroxylation. Noncarcinogenic compounds such as phenobarbitone, nikethamide, aniline, and 1,2,3,4-dibenzpyrene did not increase biphenyl 2-hydroxylation. Other microsomal drug-metabolizing enzymes (*p*-nitroanisole demethylase, nitroreductase, aniline hydroxylase, and cytochrome P-450 reductase) were unaffected by the presence of carcinogens. The results suggest that enhanced biphenyl 4-hydroxylation, but not enhanced biphenyl 2-hydroxylation, requires *de novo* microsomal enzyme synthesis.

76-0706. Guerra, M.; Comodo, N. (Ist. Ig., Univ. Camerino, Camerino, Italy). **Possibilita di utilizzazione del test di ittiotossicita per una valutazione dei limiti di accettabilita negli effluenti industriali di alcune sostanze tossiche. [Ichthyotoxicity as a means of determining the acceptability limits of toxic substances in industrial effluents.]** *Boll. Soc. Ital. Biol. Sper.* 48(22): 898-901; 1972. (3 references) (Italian)

Three fish species, *Carassium auratus*, *Alburnus albidus*, and *Salmo irideus*, were studied in vats containing mercuric chloride, potassium bichromate, ammonia, phenol, ABS, and DDT. Deaths were taken into account up till 48 hrs after the beginning of the experiment. For each substance studied, LD50 was determined as well as the mortality percentage in each species for various concentrations of the toxic substances. It seems that the ichthyotoxic method is not sensitive enough to determine concentrations of single substances superior to those allowed in effluent waters. While the method is valid for global estimates of the toxicity of industrial effluents, it does not seem to be adequate to determine the toxicity of single compounds.

76-0707. Torre, C. (Ist. Anat. Umana Norm. Farmacol. Terapia, Univ. Torino, Turin, Italy). **Azione del DFP sull'embrione di pollo. Distribuzione e DL_{50}. [Effect of DFP on the chicken embryo. Distribution and LD50.]** *Boll. Soc. Ital. Biol. Sper.* 48(22): 996-1000; 1972. (14 references) (Italian)

On the third day of incubation of fertilized chicken eggs, about 1 ml of albumin was extracted from each egg, and a small opening was made to observe the embryo and to give the injections. Two groups of 7 eggs received injections into the yolk of 0.1 mg of DFP in 0.1 ml of 1,2-propanediol containing H^3 DFP for an activity of 2μCi. In the first group, all the eggs were at day 6 of incubation, and in the second group at day 10. A third group of 7 eggs was treated, on day 6, with 10 mg of DFP under the above conditions. Six hours after the injections, yolk, albumin, vessel, and membrane activity was observed. To determine the LD50 at days 6 and 10 of incubation, groups of

about 10 embryos were given increasing dosages of DFP in propanediol. Cessation of erythrocyte movement in the vessels was considered indicative of death. Observations were made 30 hr after the DFP injection. Results indicate that as far as the quantity of DFP which reaches the embryo after injection is concerned, there are no differences on days 6 and 10 at the same dosages. The LD50 on day 10 is 0.063 mg of DFP per egg. It was impossible to determine the LD50 for day 6 since, with the largest dose administered (10 mg DFP), only 12.5% of the embryos died, similar to results obtained for embryos on day 6 of treatment with solvent only. Thus, embryos at an early developmental stage are rarely if ever affected by the toxicity of DFP; sensitivity increases as the embryo matures.

76-0708. Torre, C. (Ist. Anat. Umana Norm. di Farmacol. Terapia, Univ. Torino, Turin, Italy). **Azione del diisopropilfluorofosfato (DFP) sull'embrione di pollo. Impiego dei riattivatori delle colinesterasi. [Effects of DFP on the chicken embryo. Use of cholinesterase reactivators.]** *Boll. Soc. Ital. Biol. Sper.* 48(22): 1000-1002; 1972. (6 references) (Italian)

On the third day of incubation of fertilized chicken eggs, about 1 ml of albumin was extracted from each egg, and a small lateral opening was made to observe the embryo and to give injections. On the tenth day, about ten embryos were given increasing dosages of DFP in the yolk to determine the LD50 at that developmental stage. Another group, also on the tenth day, was given, 5 min after the DFP injection, 2.5 mg of PAM (pralidoxime) in the yolk; LD50 was also determined. The PAM, administered at that dose, was successful against a LD100 of 0.5 mg of DFP. When the erythrocytes ceased to circulate in the vessels, the embryos were declared dead. Graphed results indicate that mortality of the embryos treated with DFP only is essentially due to the anticholinesterase activity of the product; acetyldoxime, by reactivating the cholinesterases, produces a net increase in the LD50 from 0.063 to 0.75 mg of DFP per egg.

76-0709. Dessi Fulgheri, F.; Lupo di Prisco, C. (Ist. Zool. Anat. Comp., Univ. Camerino, Camerino, Italy). **Accumulo differenziale di pesticidi clorinati nei tessuti di *Turdus merula*. [Differential accumulation of chlorinated pesticides in tissues of *Turdus merula*.]** *Boll. Soc. Ital. Biol Sper.* 50(14): 1119-1124; 1974. (19 references) (Italian)

In March 1972, 7 male *T.merula* were taken from an area of about 100 km² and dissected. Samples were obtained of the brain, muscle, fat, and liver tissues to determine the presence of lindane, heptachlor epoxide, aldrin, dieldrin, *p,p'*-DDD, *o,p'*-DDT, and *p,p'*-DDT. The samples were analyzed with gas chromatography. The minimum quantity of chlorinated pesticides detected was about 0.1 to 0.5 mg/g, depending on the retention time of the substances examined. Results were tabulated for the level of each pesticide in each tissue, the average percentage incidence of each pesticide in each tissue, and the total concentration of each pesticide. Heptachlor epoxide was found in measurable quantities in the liver and in trace amounts in the other tissues. Aldrin was present in trace amounts in all the tissue samples (concentrations were slightly higher in brain tissue). Dieldrin was in notably high concentrations in the fat. There were no traces of *p,p'*-DDD in the brain tissue, but it was present in high concentrations in the other tissues. The highest concentrations of *p,p'*-DDT were in the fat and the liver; it was present in all tissues. There does not seem to be a unified consensus as to the lethal dosages for chlorinated pesticides in various tissues.

76-0710. Ruffin, J. (Dep. Biol., Atlanta Univ., Atlanta, GA 30314). **The effects of various pesticides on oxygen uptake by soil microbes.** *Bull. Ga. Acad. Sci.* 32(3-4): 76-82; 1974. (11 references)

A study was made of the effects of DDT, dieldrin, malathion and 2,4-D/2,4,5-T on the oxygen uptake of soil microbes. The rate of application for the study was chosen to approximate that used under normal application conditions in the field. The rate of oxygen uptake by the soil was measured as a standard for the biological activity of the soil. Under the conditions of this study these pesticides exerted no measurable effect on the oxygen uptake of the soil microbes. When the chemicals were applied at 10 times the usual field concentrations, no changes in oxygen uptake were noted. When applied at 100 times the recommended dosage, however, the oxygen uptake was decreased. This decrease was greatest in clay loam soil rich in organic matter. The results of this study confirm previous studies which indicate the lack of an effect at recommended field application rates and the fact that excessive amounts of chemicals must be applied before microbial activity, as measured by oxygen uptake, is significantly affected.

76-0711. Haegele, M. A.; Tucker, R. K.; Hudson, R. H. (U.S. Bur. Sport Fish. Wildl., Denver Wildl. Res. Cent., Denver, CO 80225). **Effects of dietary mercury and lead on eggshell thickness in mallards.** *Bull. Environ. Contam. Toxicol.* 11(1): 5-11; 1971. (22 references)

Female mallards (*Anas platyrhynchos*) in their first reproductive season were fed untreated food or given food containing 100 ppm metallic mercury, 200 ppm Ceresan M (3.1% metallic mercury), and/or 40 ppm *p,p'*-DDE. All diets were provided ad libitum from early February until April, and all eggs laid on the 76th and 85th days of treatment were collected and analyzed. In addition, 89 days after treatment began, all birds were killed and analyzed. DDE alone caused a 15% reduction in eggshell thickness, but neither the mercury nor the lead diets caused any significant thinning. Lead and mercury had no apparent synergistic or additive effects when fed in combination with DDE. The mercury concentrations in the egg contents of the mercury-fed birds were 15-19 times higher than the average level (0.083 ppm) previously found in Califor-

nia brown pelican eggs, and the lead concentrations in the bone were 30-100 times higher than the mean lead concentrations (0.36 ppm) previously found in the bones of Anacapa brown pelicans. The bone lead residues were 3 times higher in the birds fed lead plus DDE than in those fed lead alone, suggesting that DDE alters calcium mobilization in treated birds.

76-0712. Karnak, R. E.; Collins, W. J. (Dep. Entomol., Ohio State Univ., Columbus, OH 43210). **The susceptibility to selected insecticides and acetylcholinesterase activity in a laboratory colony of midge larvae, *Chironomus tentans* (Diptera: Chironomidae).** *Bull. Environ. Contam. Toxicol.* 12(1): 62-69; 1974. (15 references)

Third or fourth instar *Chironomus tentans* Fabricius larvae were exposed to solutions containing known amounts of dieldrin, allethrin, DDT, dieldrin, dichlorvos, chlorpyriphos, malathion, carbaryl, carbofuran, methiocarb, mexacarb, propoxur, and/or PBO. Mortality was assessed after 24 hr and the acetylcholinesterase (AChE) levels in larval homogenates were measured spectrophotometrically. All of the insecticides tested were toxic in the ppb range. Dieldrin was the most toxic of the compounds tested (LD50 0.91 ppm) and DDT was the least toxic (LD50 19.5 ppb). Carbaryl was not synergized by piperonyl butoxide (PBO), although allethrin was synergized to a small degree. The in vitro assays for AChE demonstrated low levels of activity in the midge homogenates. Since the organophosphates and carbamates are toxic by virtue of AChE inhibition; larval susceptibility to these insecticides may have been due to low quantities of the target enzyme. It is likely that *C.tentans* utilizes the oxidative multifunction oxidase system for metabolizing insecticides, at least when adequate dissolved oxygen is present.

76-0713. Grant, D. L.; Shields, J. B.; Villeneuve, D. C. (Health Protect. Branch, Bureau Chem. Safety, Health Welfare Canada, Ottawa, Ontario, Canada). **Chemical (HCB) porphyria: effect of removal of sex organs in the rat.** *Bull. Environ. Contam. Toxicol.* 14(4): 422-425; 1975. (10 references)

Castrated and normal male and ovariectomized and normal female Sprague-Dawley rats were fed diets containing 100 or 500 ppm HCB. The animals were killed after various intervals and their livers weighed and analyzed for porphyrins. The hepatic porphyrin levels were higher in the males than in the females. Removal of the testes increased the porphyrin levels in the males fed 100 ppm HCB, while removal of the ovaries decreased the hepatic porphyrin levels in the females. At 500 ppm, HCB appeared to mask the effect of castration and ovariectomy on the accumulation of porphyrins in the liver. In conjunction with previous data, these results demonstrate that the steroids produced by the ovaries and testes are involved in the mechanism by which HCB induced porphyria in the rat.

76-0714. Kobylinski, G. J.; Livingston, R. J. (Dep. Biol. Sci., Florida State Univ., Tallahassee, FL 32306). **Movement of mirex from sediment and uptake by the hogchoker, *Trinectes maculatus*.** *Bull. Environ. Contam. Toxicol.* 14(6): 692-698; 1975. (9 references)

Juvenile hogchokers (*Trinectes maculatus*) were maintained for 4 weeks in aquaria containing 3.5 kg of coarse silica sand (about 4 cm deep) spiked with 500, 1650, or 5000 ppb of technical grade mirex dissolved in hexane. Some of the aquaria were maintained under static water conditions and water flowed through others at a constant rate of 30 ml/min. Weekly sediment, water, and tissue samples were analyzed by gas chromatography. Under static conditions, virtually all of the mirex remained within the sediment, whereas under the constant flow conditions, about 40% of the initial insecticide was lost from the sediment during the 4 week study period. The mirex levels in the water were directly proportional to the levels in the sediment; the levels in the water required an equilibrium during the first week and declined thereafter. The uptake of mirex by the fish tissues showed a dose-dependent relationship and continued to increase with time. Declining mirex concentrations in the water indicated that the insecticide was being absorbed from the water by the fish. However, considerably more mirex was taken up by the fish than was lost by the water, indicating that the fish probably absorbed a significant amount of pesticide from the sediment.

76-0715. Pawar, S. S.; Makhija, S. J. (Biochem. Div., Dep. Chem., Marathwada Univ., Aurangabad, India). **Hepatic aminopyrine *N*-demethylase, acetanilide hydroxylase and lipid peroxidation in young growing rats during the treatment of insecticides.** *Bull. Environ. Contam. Toxicol.* 14(6): 714-720; 1975. (19 references)

Young male and female CF rats were given two consecutive daily ip injections of baygon (10 mg/kg), take-20 (*O,O*-dimethyl malathion, 150 mg/kg), baygon + take-20 (10 mg/kg + 150 mg/kg), or the corn oil vehicle alone. The animals were killed 24 hr after the last injection. The relative liver weights increased during insecticide intoxication, the increase being greater in the males after baygon treatment and greater in the females after take-20 or baygon = take-20 treatment. Baygon and baygon + take-20 decreased the 9000 × *g* supernatant liver protein content in the males, while the combined treatment increased the hepatic protein levels in the females. The protein content was increased by take-20 in the males and decreased in the females. Hepatic aminopyrine *N*-demethylase activity was decreased by baygon and increased by take-20 and baygon + take-20. The inhibitory effect of PCMB on this enzyme was reduced by baygon and increased by take-20 and the combined treatment. The activity of hepatic acetanilide hydroxylase was increased by take-20 and decreased by baygon and the combined treatment; the changes were greater in the males than in the females. Baygon and take-20 alone increased the enzymatic and nonenzymatic lipid peroxidation, but in com-

bination, they increased lipid peroxidation in the males and decreased it in the females.

76-0716. Watkins, J.; Yarbrough, J. D. (Dep. Zool., Mississippi State Univ., Mississippi State, MS 39762). **Aldrin and dieldrin uptake in insecticide- resistant and susceptible mosquitofish (*Gambusia affinis*).** *Bull. Environ. Contam. Toxicol.* 14(6): 731-737; 1975. (10 references)

Insecticide-resistant and -susceptible mosquitofish (*Gambusia affinis*) were exposed to ^{14}C-aldrin and ^{14}C-dieldrin at various concentrations for varying periods of time. The insecticide concentrations in the tissues of the resistant and susceptible fish did not differ when the fish were exposed to 10 ppb insecticide. However, at 80 ppb aldrin the whole-body insecticide levels were 8.5-fold higher in the susceptible fish than in the resistant fish. There were significantly higher levels of both pesticides in the muscle and brain tissues and significantly higher aldrin levels in the liver of the susceptible fish as compared with the resistant fish. Within the susceptible population, the whole body aldrin concentrations were similar in fish showing signs of poisoning and in those showing no signs of poisoning. However, the dieldrin levels were higher in the symptomatic susceptible fish than in the non-symptomatic susceptible fish. There were no differences in the insecticide levels in the various tissues. The data suggest the presence of an effective insecticide barrier in resistant fish.

76-0717. Hollister, T. A.; Walsh, G. E.; Forester, J. (U.S. Environ. Protect. Agency, Gulf Breeze Environ. Res. Lab., Sabine Island, Gulf Breeze, FL 32561). **Mirex and marine unicellular algae: accumulation, population growth and oxygen evolution.** *Bull. Environ. Contam. Toxicol. 14(6): 753-759; 1975. (7 references)*

Algae (cholorphytes *Chlorococcum* sp., *Dunaliella tertiolecta* Butcher, and *Chlamydomonas* sp; bacillariophytes *Nitzschia* sp and *Thallasiosira pseudonana* Hasle and Hundal; and rhodophyte *Porphyridium cruentum* (Ag.) Naeg) were exposed to mirex in artificial sea water supplemented with trace elements and vitamins. The pesticide effects on population growth and oxygen evolution were determined as was the pesticide accumulation by the organisms. Mirex (0.2 ppb) had no effect on population growth or oxygen evolution regardless of the salinity of the water (5-30 ppt). Among organisms exposed to 10-50 ppt mirex for 7 days, *Chlorococcum* sp. accumulated 88% of the pesticide in the medium, *Dunaliella tertiolecta* and *T. pseudonana* accumulated 79%, and *Chlamydomonas* took up 55%. There was a linear relationship between the amounts of mirex accumulated and the concentration in the medium. The results indicate that marine unicellular algae could accumulate mirex and, when grazed upon, act as passive transporters of the toxicant to consumers in the food chain.

76-0718. Arthur, R. D.; Cain, J. D.; Barrentine, B. F. (Mississippi Epidemiol. Studies Program, Dep. Biochem., Mississippi State Univ., Mississippi State, MS 39762). **The effect of atmospheric levels of pesticides on pesticide residues in rabbit adipose tissue and blood sera.** *Bull.. Environ. Contam. Toxicol.* 14(6): 760-764; 1975. (6 references)

Five-mo-old male and female white rabbits were housed in open cages under an aluminum roof in an area of high pesticide use (Stoneville, Mississippi) or in cages inside a small animal building in an area of low pesticide use (Mississippi State, MS). The animals were sacrificed 3 mo later, and the pesticide residue levels in the blood and abdominal adipose tissue determined by electron capture gas chromatography. The pesticide concentrations in the air were measured weekly. The residue levels in the adipose tissue were higher in the Stoneville rabbits than in the Mississippi State rabbits. The difference was greatest for DDT and metabolites, the total DDT residues being 10-fold higher in the Stoneville rabbits than in the Mississippi State rabbits. No pesticide residues were detected in the sera of the Stoneville rabbits and less than 1 ppb DDT was detected in the sera of only 6 of 20 Mississippi State rabbits. The increased residue levels in the adipose tissue of the Stoneville rabbits was attributable to atmospheric pesticides.

76-0719. Bedford, C. T.; Crawford, M. J.; Hutson, D. H. (Shell Res. Ltd., Tunstall Lab., Sittingbourne Res. Cent., Sittingbourne, Kent, England). **Sulphoxidation of cyanatryn, a 2-mercapto-*sym*-triazine herbicide, by rat liver microsomes.** *Chemosphere* 4(5): 311-316; 1975. (8 references)

When the new herbicidal *sym*-triazine, cyanatryn (I; 2-methylthio-4-ethylamino-6-(1-cyano-1-methylethylamino)-*sym*-triazine) was incubated with the postmitochondrial supernatant (10,000 g) fraction of male rat liver, it was partly converted into a mixture of primarily *N*-de-ethyl-(I) and the corresponding hepatic glutathion (GSH) conjugate. Cytosol in the presence of GSH had no action on (I). When (I) was incubated with washed rat liver microsomes, together with the co-factors required for monooxygenase action, it was extensively converted (74%) into *N*-de-ethyl-(I) (16%), an unknown metabolite (A) (40%), and several other more polar products. These conversions were completely inhibited by the omission of all co-factors, the omission of only G-6-P dehydrogenase, or by the inclusion of the monoxygenase inhibitor, metyrapone (0.1 mM). When GSH was included in the incubates, the major products were de-ethyl-(I) and the GSH conjugate, suggesting that (A) had reacted with GSH. Male rat microsomes were more effective than female rat microsomes in effecting the formation of (A). Metabolite (A) was identified as the *S*-oxide of (I). It is likely that the microsomal oxidation of (I) to yield (A) is the initial step in the in vivo formation of mercapturic acid. The second step is the reaction of (A) with GSH to form the glutathione conjugates.

76-0720. Ernst, W. (Inst. Meeresforschu., Bremerhaven, Germany). **Aufnahme, Ausscheidung und Umwandlung von Lindan-14C durch *Mytilus edulis*.** [Absorp-

tion, secretion and metabolism of lindane-^{14}C by *Mytilus edulis*.] *Chemosphere* 4(6): 375-380; 1975. (4 references) (German)

The absorption, secretion, and metabolism of ^{14}C-labeled lindane in the common mussel, *Mytilus edulis*, was studied by scintillation scanning method. The initial concentration of lindane in the seawater was 2 ppb, after which it was varied between 2.98 and 0.02 ppb by the addition of lindane or by the replacement of the water by lindane-free water. Independent of the initial lindane concentration in the water, a more or less constant steady-state concentration was found to build up in the animals in 2 to 5 days. Rapid reduction of the lindane concentration to 4% of the original level was observed after threefold replacement of the contaminated water by lindane-free seawater. The concentration factor, representing the ratio of the lindane concentration in the animal versus the seawater, ranged from 74 to 109 at all concentrations in the water, but it was 242 at 0.02 ppb lindane concentration in the seawater.

76-0721. Saint-Ruf, G.; Do-Phuoc Hien (Cent. Marcel Delepine, CNRS, 45045 Orleans Cedex, France). **Similitudes des effets biochimiques, chez le Rat, de la tetrachloro-2,3,7,8 dibenzo-*p*-dioxine et de la tetrabromo-2,3,7,8 dibenzo-*p*-dioxin.** [**Similarity of the biochemical effects of 2,3,7,8-tetrachloro-dibenzo-*p*-dioxin and 2,3,7,8-tetrabromodibenzo-*p*-dioxin in the rat.**] *C. R. Hebd. Seances Acad. Sci. Paris Ser. D* 280(23): 2709-2711; 1975. (8 references) (French)

The effect of 2,3,7,8-tetrabromodibenzo-*p*dioxin, a homolog of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin, on liver enzymes was studied in rats. Administered to male Wistar rats in an oral dose of 20-0.0015 mg/kg, 2,3,7,8-tetrabromodibenzo-*p*-dioxin caused very powerful induction of zoxazolamine hydroxylase, as determined from the reduction of the duration of zoxazolamine-induced paralysis. Adminstered to male Sprague-Dawley rats in a dose of 2 mg/kg (1 to 4 i.p. injections at 5-day intervals) 2,3,7,8-tetrabromodibenzo-*p*-dioxin caused considerable loss of weight, and highly significant reduction of the hepatic arginase activity. The effect of 2,3,7,8-tetrabromodibenzo-*p*-dioxin on the liver enzymes was comparable both in its nature and intensity to that of the chlorinated analog. Necrotic lesions of the median lobe of the liver was found on autopsy. The findings indicate a very close relationship between the biological properties of dioxins and the perfectly symmetrical molecular structure.

76-0722. Hansen, L. G.; Metcalf, R. L.; Kapoor, I. P. (Dep. Entomol., Univ. Illinois, Urbana, IL 61801). **Biochemistry of selective toxicity and biodegradability. II. Comparative in vivo and microsomal *O*-dealkylation by mice and flies.** *Comp. Gen. Pharmacol.* 5(2): 157-163; 1974. (16 references)

The rates of *p*-nitrophenyl alkyl ether *O*-dealkylation in male and female mice were found to vary with chain length in the following order: house flies (*Musca domestica*), methyl>ethyl>*n*-propyl>*n*-butyl; flesh flies (*Sarcophaga bullata*), methyl + ethyl>*n*-propyl>*n*-butyl; and mice, ethyl>methyl>*n*-propyl>*n*-butyl. In all species, methoxychlor was *O*-dealkylated at a greater rate than ethoxychlor, and ethoxychlor was the most toxic analogue. The in vivo activity of these pesticides correlated in order of magnitude with the in vitro microsomal *O*-dealkylation rate in all cases. The in vitro differences in activity were reduced at higher substrate conditions, and evidence is presented to indicate the presence of both high affinity and low affinity enzymes or active sites which act on the same substrates.

76-0723. Rosic, N.; Lomax, P.; Kovacevic, N. (Inst. Biochem., Fac. Med., Univ. Belgrade, Belgrade, Yugoslavia). **The toxic and behavioural effects of a cholinesterase inhibitor in fish (*Serannus-scriba*).** *Comp. Gen. Pharmacol.* 5(2): 187-189; 1974. (8 references)

The cholinesterase inhibitor armine was shown to have a calculated LD50 of 120 μg/kg in the fish *Serranus scriba* as compared with a value of 500 μg/kg which has been reported in mice. At a dose level of 60 μg/kg (s.c.), armine caused marked depression in the active avoidance behavior of *Serranus scriba* for up to 6 hr after injection. Complete recovery of the avoidance response occurred by 24 hr. The same dose of armine reduced the brain cholinesterase activity of the fish to 80% of control levels 2 hr after administration, with return towards normal values after 6 hr and complete recovery by 24 hr. Although the results are not conclusive, the time course of the behavioral deficit and enzyme depression suggest a direct causal relationship.

76-0724. Stromborg, K. L. (Michigan State Univ., East Lansing, MI). **Sub-lethal effects of seed treatment pesticides on breeding hen pheasants.** *Diss. Abstr. Int. B* 36(6): 2547-2548; 1975.

Three seed treatment pesticides, the fungicide captan and the insecticides dieldrin and Diazinon, were tested for sublethal effects on laying female pheasants (*Phasianus colchicus*). In the single dose level experiment, food consumption was initially depressed by all single treatments and depressed additively by the combination treatments. Over the course of the experiment, food consumption declined in the control dieldrin, and captan groups. The diazinon group and the combination groups had the lowest initial level and did not change over time. Decreased egg production was the only significant reproductive effect. During pesticide administration, the rate of egg laying decreased with increasing doses of diazinon above 1.05 mg/day. The number of days to recovery from this effect increased with increasing doses above 2.10 mg/day. No diazinon effects on hatchability or chick survival were detected. No reproductive effects were observed during a 12 day period commencing 13 days after

the last pesticide dose. Birds which were given 7 pesticide treatments did not differ in egg laying rate or recovery interval from those given 14 doses implying no cumulative effect of Diazinon. During the treatment period, hens lost body weight in relation to dose above 1.05 mg/day. Analysis of the reproductive status and crop contents of pheasants collected in the field showed that agricultural foods made up the largest portion of the diet of breeding birds. Residue analysis showed that 45 percent of the birds sampled had consumed food contaminated with seed treatment pesticides. On the basis of laboratory and field results, it was concluded that the use as a seed treatment of Diazinon alone or in combination with captan represents a potential hazard to the reproductive performance of pheasants. The degree of hazard depends on the availability and utilization of treated seed by pheasants. The amount of treated seed necessary to reach an effective dose rate was estimated to be 6 percent to 12 percent of the daily food intake of a breeding hen pheasant. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 75-27, 342.)

76-0725. Di Gaudio, M. R. (New York Univ., New York City, N.Y.). **Thallium: some effects of an environmental toxicant.** *Diss. Abstr. Int. B* 36(6): 2573; 1975.

The effect of thallium nitrate and thallium acetate on growth, respiration and extracellular polysaccharide production was studied in *Anacystis nidulans*, *Chlorella vulgaris* and *Paramecium bursaria*. The threshold concentration (TC) was found to be 3 ppm and the limiting concentration (LC) was found to be 7 ppm for the algae and 9 ppm for the ciliate. Photosynthetic respiration was found to be suppressed and cellular respiration as well as extracellular polysaccharide production were affected. The effects of the organic salt and inorganic salt on the parameters studied differed in each organism. (Author abstract by permission. Copies of the thesis are available from University Microfilms, Order No. 75-28, 520.)

76-0726. Bus, J. S. (Michigan State Univ., East Lansing, MI). **Paraquat perinatal toxicity and a proposed mechanism of action involving lipid peroxidation.** *Diss. Abstr. Int. B* 36(6): 2748; 1975.

Paraquat, in the drinking water of pregnant Swiss-Webster mice at 50 and 100 ppm at day 8 of gestation and with continued exposure of the pups to 42 days postnatally, did not at any time alter the average litter body weights compared to controls. One hundred ppm, but not 50 ppm, paraquat significantly increased postnatal mortality in a biphasic manner, with an initial 33% increase in mortality reached between days 7 and 28 postnatally. Mortality was 67% at 42 days after birth. Pulmonary lesions consisting of edema, thickening of alveolar septa, and alveolar consolidation were observed in the 100 ppm but not 50 ppm paraquat treated mice at 42 days postnatally. Liver and kidney were not affected. Concentrations of paraquat in lungs of 100 ppm paraquat treated mice were less than 0.2 μg/g tissue at 42 days postnatally and nondetectable in lungs of 50 ppm paraquat treated mice. Both 50 and 100 ppm paraquat treated mice were more sensitive to 100% oxygen exposure at 42 days after birth than controls as determined by a significant reduction in the median time to death (LT50) in oxygen. The LT50 for control animals in oxygen was 160 hours versus LT50's of 108 and 40 hours for 50 and 100 ppm paraquat treatments, respectively. Sensitivity to 100% oxygen was detectable in 100 ppm but not 50 ppm paraquat treated mice at days 1 and 28 postnatally. In 42 day old mice, the LT50 after 3100 mg/kg ip bromobenzene (LD85) was 4.2 and 3.2 hours in 50 and 100 ppm paraquat treated mice, respectively, compared to the LT50 in controls of 20.0 hours. Under anaerobic conditions in vitro, paraquat was reduced to the blue-colored free radical by a single electron reduction reaction catalyzed by mouse lung microsomes and NADPH. The in vitro and in vivo experiments suggest that lipid peroxidation of cellular membranes may be involved in paraquat toxicity. Paraquat may undergo a cyclic reduction-oxidation in vivo, with subsequent formation of superoxide radicals. Superoxide radicals can nonenzymatically dismutate to singlet oxygen, which reacts with unsaturated lipids associated with cell membranes to form lipid hydroperoxides. The lipid hydroperoxides can initiate the membrane damaging chain reaction process of lipid peroxidation. The result of such a process is loss of cellular function and integrity. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 75-27, 244.)

76-0727. Couch, R. C. (Univ. Kentucky, Lexington, KY). **Distribution and excretion of the trichloromethylsulfenyl fungicides in rats and their effects on isolated liver nuclei, histones, nonhistone nuclear proteins and DNA.** *Diss. Abstr. Int. B* 36(6): 2749-2750; 1975.

The reactions of captan, folpet and thiophosgene with calf thymus histones, total rat liver histones and isolated rat liver nuclei were studied utilizing labeled fungicides, polyacrylamide gel electrophoresis, nucleohistone reconstitution experiments and thermal denaturation. The binding of radioactivity from either ^{35}S-captan or ^{14}C-folpet and changes in polyacrylamide gel patterns of captan-treated calf thymus histones were pH-dependent. The data suggest that the intact molecule binds to deprotonated sites on the lysine-rich histones. This binding causes changes in the configuration of the protein molecule which alters the ability of nuclear histones to stabilize DNA structure. Appreciable amounts of the radioactivity from ^{35}S-captan were bound by isolated nuclei from the livers of normal and partially hepatectomized rats. Electron microscopy revealed no gross morphological alterations in isolated nuclei treated with captan. Excretion and distribution of single and multiple intraperitoneal doses of ^{35}S-captan and ^{14}C-folpet were investigated in normal and 70% hepatectomized male rats. There were no apparent differences between normal and hepatectomized rats. In sum-

mary, the data obtained in studies with isolated histones and nuclei suggest that the trichloromethylsulfenyl fungicides exert a direct toxic effect, through the trichloromethylthio moiety, on the genetic material, especially the protein components. However, in the intact animal such an effect is probably limited by the rapid breakdown and excretion of the fungicides and a lack of accumulation of the toxic residues in tissues. (Author abstract reprinted by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 75-26, 444.)

76-0728. Seifert, J.; Vacha, J. (Inst. Pharmacol., Czechoslovak Acad. Sci., Prague, Czechoslovakia). **Sex-dependent differences in the biosynthesis of pyrimidine nucleotides in rat liver after repeated administration of α-hexachlorocyclohexane.** *Drug Metab. Dispos.* 3(6): 430-436; 1975. (32 references)

Utilization of (2-^{14}C)orotic acid for the synthesis of the pyrimidine components of the free nucleotide pool and RNA from isolated cytoplasmic ribosomes were investigated using the livers of male and female Wistar rats. In the females, labeled orotic acid was incorporated after ip administration relatively more into uridine than cytidine nucleotides. The opposite was true for the males. The administration of α-hexachlorocyclohexane (α-BHC, p.o.) decreased the specific radioactivity of rRNA cytidylic acid more in males than in females. Simultaneously, the level of hepatic microsomal cytochrome P-450 was increased after α-BHC administration in males more than in females. After 4 days of treatment with α-BHC, the concentrations of the uridine and cytidine components of the acid-soluble pool were slightly depressed. Following repeated α-BHC administration, the utilization of labeled uridine for the synthesis of cytidine nucleotides in the acid-soluble pool and RNA was depressed, whereas that of labeled cytidine was enhanced. Repeated administration of α-BHC decreased the utilization of (2-^{14}C)orotic acid for the synthesis of cytidine nucleotides of DNA and increased the specific radioactivity of thymidylic acid. The administration of β-diethylaminoethyl diallylacetate to animals treated with α-BHC decreased the specific radioactivity of DNA thymine.

76-0729. Mehandale, H. M.; El-Bassiouni, E. A. (Pharmacol. Branch, Natl. Inst. Environ. Health Sci., Jackson, MS 39216). **Uptake and disposition of aldrin and dieldrin by isolated perfused rabbit lung.** *Drug Metab. Dispos.* 3(6): 543-556; 1975. (27 references)

The uptake, metabolism, and release of aldrin and dieldrin by the lungs were studied using isolated perfused male New Zealand rabbit lungs that were artificially ventilated and perfused through the pulmonry artery. Both recirculating and single-pass experiments were conducted using an artificial medium as perfusate. Aldrin accumulated in the lung from the perfusate via two distinct uptake phases: a rapid phase involving simple diffusion and nonspecific binding, and a slower phase representing its metabolic turnover as dieldrin. Dieldrin was not metabolized but accumulated in the lungs via a saturable and a nonsaturable process. Single-pass experiments with aldrin indicated that the initial velocity of uptake could be fitted to one component and a constant representing the rate of metabolism. The uptake of dieldrin was biphasic: one phase was independent of the perfusate concentration and the other was saturable with respect to the perfusate concentration. By application of Michaelis-Menten kinetics, the maximum amount of dieldrin accumulation attributable to the saturable component was calculated to be 0.64 μM/lung. The data indicate that the accumulation of these chlorinated xenobiotics takes place through the processes of simple diffusion followed by nonspecific tissue binding. There was no evidence for the irreversible binding of aldrin or dieldrin in the lung. While the lung plays a major role in metabolizing aldrin to dieldrin followed by transient storage, neither substrate has the potential for long-term storage in the lung.

76-0730. Dura, Gy.; Szlobodnyik, J.; Csuka, I.; Desi, I. (National Inst. Public Health, Budapest, Hungary). **Peszticidek szovettenyeszetre gyakorolt hatasanak vizsgalata.** [**Effect of pesticides on tissue cultures.**] *Egeszsegtudomany* 19(3): 265-276; 1975. (27 references) (Hungarian)

The effect of lindane, malathion, bromophos, trichlorfon, arprocarb (propoxur), dioxacarb, and benlate (benomyl) was studied on monkey kidney cell cultures incubated at 37°C. Water-insoluble pesticides were added to the culture in the form of 1% solution in dimethylformamide. The threshold concentrations at which the pesticides exhibited their growth-inhibiting and cytotoxic action on the development of the monolayer were 200 ppm for lindane and benlate; 50 ppm for malathion, bromophos, and dioxycarb; and 100 ppm for trichlorfon and arprocarb. Concerning the cytotoxic effect on the already established monolayer, the threshold concentrations were 50 ppm for malathion and bromophos, 10 ppm for dioxycarb, 100 ppm for lindane, 200 ppm for trichlorfon, benlate, and arprocarb. All pesticides were highly toxic in 400 ppm concentration. There was no correlation between the cytotoxic concentrations and the LD50 values determined for warm-blooded animals. The tissue culture test was found to be more sensitive than the functional neurotoxicological test for all pesticides except lindane and arprocarb. The findings indicate that in vitro permanent cell cultures can be successfully applied together with the in vivo functional toxicological tests but they can not be used alone.

76-0731. Lee, R. M.; Brindley, W. A. (Dep. Biol., Utah State Agric. Exp. Stn., Utah State Univ., Logan UT 84322). **Synergist ratios, EPN detoxication, lipid, and drug-induced changes in carbaryl toxicity in *Megachile pacifica*.** *Environ. Entomol.* 3(6): 899-907; 1974. (11 references)

Megachile pacifica (Panzer) generally became more susceptible to carbaryl as the adults aged. LD50 values for carbaryl toxicity were 240, 166.5, 109,2, and 51.3 μg/g for the 1, 2, 3, and 4-day-old adult male bees. For the female bees, these values were 245.5, 550.5, 289.4, and 262.4 μg/g. Lipid content and in vitro EPN detoxication decreased in both sexes as the bees aged. Synergist ratios were measured. They are the ratio of the LD50 of carbaryl alone to the LD50 of carbaryl applied after the synergist piperonyl butoxide. These ratios, which did not correlate with either decreasing LD50 values or decreasng EPN detoxication in the males, were 12, 21, 42, and 53 for the 1, 2, 3, and 4-day-old bees. In female bees the synergist ratios corresponded more closely. They were 23, 49, 11, and 15 as the females aged from 1 to 4 days. The bees were very susceptible to the organophosphates monocrotophos, dicrotophos or Gardona (tetrachlorvinphos) [2-chloro-1-(2,4,5-trichlorophenyl)vinyl dimethyl phosphate], LD50 < 2 μg/g), but tolerant to the carbamate Landrin (3,4,5-trimethylphenyl methylcarbamate; 2,3,5-trimethylphenyl methylcarbamate). The use of enzyme-inducing drugs to protect bees from carbaryl poisoning was studied. Among the 3 drugs used, only chlorcyclizine increased the LD50 value (to ca. 2-fold) in the 4-day-old male. Aminopyrine increased the male's susceptibility to carbaryl while phenobarbital had no effect at all. None of the drugs significantly changed the female's susceptibility to carbaryl except aminopyrine which lowered the LD50 from 262.4 to 75.3 μg/g. Studies with in vitro EPN detoxication indicated that all 3 drugs caused increases in microsomal enzyme activity up to 4 or 5-fold and decreases in lipid content of ca. 20-30%. (Author abstract by permission.)

76-0732. Haley, T. J.; Farmer, J. H.; Harmon, J. R.; Dooley, K. L. (U.S. Dep. Health, Educ. Welfare, FDA, Natl. Cent. Toxicol. Res., Jefferson, AR 72079). **Estimation of the LD1 and extrapolation of the LD0.1 for five organothiophosphate pesticides.** *J. Eur. Toxicol.* 8(4): 229-235; 1975. (12 references)

LD1 values were found for five organothiophosphate pesticides and the slopes and reproducibility of the dose-response curves were used to predict and extrapolate to doses producing lower mortality, LD0.1. Oral LD50 determined in CD-1 male and female mice in mg/kg are: parathion, 15.0 and 14.3; methyl parathion, 14.5 and 19.5; guthion, (azinphosmethyl) 7.15 and 6.35; imidan, (phosmet) 25.2 and 23.1; sumithion, (fenitrothion) 1,045 and 1,220. The toxicity was greater in males with methyl parathion and greater in females with guthion. Parathion was more toxic for females than methyl parathion, but there was no difference in the males. The relation between chemical structure and toxicity was considered. The addition of a methyl group in the *meta* position of the nitrophenyl group, as in sumithion, was seen to decrease toxicity 72 times compared to methyl parathion. The predicted LD1 and extrapolated LD0.1s were determined for each compound. It was shown that the slopes of the curves (male vs. female) obtained with 50, 100, and 660 animals are paralled for all compounds except parathion in the 660 mouse experiments. From the results of this study there can be little doubt that small increments of the LD50 can give insight into pesticide toxicity. Further, these results make it imperative that formal controls be exercised over such micropollutants to decrease and prevent human exposure. This is of prime importance in agriculture where continuous exposure to low levels of anticholinesterase compounds can lead to incapacitation.

76-0733. Zech, R.; Wigand, K. D. (Physiol.-Chem. Inst. Univ., Gottingen, Germany). **Organophosphate-detoxicating enzymes in *E. coli*. Gelfiltration and isoelectric focusing of DFPase, paraoxonase and unspecific phosphohydrolases.** *Experientia* 31(2): 157-158; 1975. (11 references)

Organophosphate-detoxicating enzymes in *E. coli* were determined titrimetically, manometrically, colorimetrically, and, in the case of DFPase, by measuring liberated fluoride with an ionsensitive electrode. DFP was used as substrate for the determination of DFPase activity, and paraoxon was used for the determination of paraoxonase. Determinations were also made of alkaline and acid phosphatase and phosphodiesterase. DFPase and paraoxonase could be clearly separated by gelfiltration. Neither enzyme hydrolyzed *p*-nitrophenylphosphate or bis-*p*-nitro-phenylphosphate at acid or alkaline pH. Four DFPase peaks with isoelectric points of 5.3, 5.7, 6.1, and 7.8 were demonstrated, the phosphohydrolases showing similar or identical isoelectric points. *E. coli* DFPase had a low substrate affinity and showed pure Michaelis-Menten kinetics. The pH optimum was 8.3, whereas that for paraoxonase was 9.3. The extracted phosphorylphosphatases were unstable at room temperature. *E. coli* DFPase and paraoxonase are unsuitable tools for preparing efficient enzymatic protectors against organophosphate poisoning in mammals.

76-0734. Prozorovskiy, V. V.; Artem'ev, V. S.; Tonkopiy, V. D.; Konstorum, M. G. (S. M. Kirov Military Medical Academy, Leningrad, USSR). **Sopostavlenie antikholinesteraznoy aktivnosti i effektivnosti antikholinesteraznykh sredstv. [Comparison of the anticholinesterase activity and the efficacy of anticholinesterase agents.]** *Farmakol. Toksikol. (Moscow)* 38(4): 402-406; 1975. (13 references) (Russian)

The anticholinesterase, cholinomimetic, cholinopotentiating, and cholinolytic activity of armine, oxazil, galanthamine, physostigmine, neostigmine, and tacrine was studied on rat brain, and on muscles, urinary bladders, and intestines of cats and rabbits. All substances were found to have an anticholinesterase effect, which determines the qualitative specificity of their action. The non-anticholinesterase activity was weakest for tacrine; oxazil was found to be an active anticholinesterase agent, and had a potentiating effect on *n*-cholinoreactive substrates. Physostigmine was found to have anticholines-

terase, m-cholinomimetic, and m-cholinosensitizing properties. Neostigmine showed pronounced n-cholinopotentiating and weak m-cholinomimetic action. Galanthamine showed a strong n-cholinopotentiation effect. Oxazil exhibited selective action on striated muscle, while whysostigmine affected predominantly the intestine; galanthamine and neostigmine were less selective, i.e., they affected both systems. The therapeutic spectrum is widest for oxazil, and narrowest for neostigmine.

76-0735. Smirnova, O. I.; Gurina, E. I.; Zhigalova, L. V.; Arestova, L. S. (S. M. Kirov Military Medical Academy, Leningrad, USSR). **K voprosu o teksichnosti i perenostimosti toksogonina.** [**Toxogonin toxicity and tolerance.**] *Farmakol. Toksikol. (Moscow)* 38(4): 467-470; 1975. (22 references) (Russian)

The acute toxicity of toxogonin was studied in mice, rats, guinea pigs, cats, and dogs as compared with that of dipyroxime, and the tolerance of the organism for therapeutic doses of toxogonin (2.5 mg/kg for dogs, and 10 mg/kg for guinea pigs and rats) were studied. Toxogonin was found to be considerably less toxic than dipyroxime, and to have a better therapeutic index than the latter. The LD50 of toxogonin after i.p. injection in mice was determined to be 136 mg/kg, against 53.5 mg/kg for dipyroxime. The s.c., oral, i.p., and i.m. LD50s of toxogonin in rats were found to be 183 mg/kg, 2,240 mg/kg, 189 mg/kg, and 231 mg/kg, respectively. The i.m. LD50 was 91 mg/kg in guinea pigs and 135 mg/kg in cats. Toxogonin failed to change the duration of hexenal-induced sleep, the hepatic transaminase activity, and did not alter the diuresis, nor the color and turbidity index of the urine. Slight reduction of the blood sugar level was observed during the first 7 days of treatment with therapeutic doses. Toxogonin did not affect the cardiovascular system, and did not produce any local irritation after i.m. injection.

76-0736. Karbach, Ya. I.; Glukhova, L. G.; Rybak, P. G. (Dep. Biochem., N. I. Pirohov Vinnitsa Med. Inst., USSR). **Vliyanie polikhlorpinena na kholatoobrazuyushchuyu i kon'yugiruyushchuyu funktsiyu pecheni.** [**Influence of polychloropinene on the cholate-forming and conjugating function of the liver.**] *Farmakol. Toksikol. (Moscow)* 38(4): 488-490: 1975. (4 references) (Russian)

The effect of acute and chronic poisoning with polychloropinene on bile synthesis and on the conjugation of bile acids with taurine and glycine was studied in male chinchilla rabbits. Inhibition of the bile acid synthesis was observed in rabbits fed a single dose of 514 mg/kg (LD50), and rabbits fed 10% of LD50 on the first, third, and sixth days. Sharp reduction of the conjugation of bile acids with taurine and glycine was observed. Significant activation of the bile acid synthesis, and inhibition of bile acid conjugation with glycine were demonstrated in rabbits fed 1/50 of LD50 of polychloropinene for 1, 3, or 12 months. The findings indicate that the changes in the bile acid spectrum can be used in liver function tests in case of lesions of the hepatic parenchyma.

76-0737. Komala, Z. (Inst. Systematic Exptl. Zool., Dep. Exp. Zool., Polish Acad. Sci., Cracow, Poland). **The effect of some pesticides on *Paramecium aurelia*.** *Folia Biol. (Krakow)* 32(3): 231-243; 1975. (7 references)

The toxicity of Gesagard 50 (prometryn) and Miedzian 50 (copper oxychloride) to a microorganism was studied. Experiments were carried out on the Polish strain of *Paramecium aurelia* belonging to syngen 1. Both compounds in 0.1% and 0.01% dilutions were very toxic, causing death of the examined paramecia after 10-20 min or after about 4-21 hr, respectively. It appeared that Miedzian 50 was the more toxic agent, as with the use of Gesagard 50 it was possible to obtain durably viable clones in 6 cases. The greater toxicity of Miedzian 50 may be conditioned by the presence of copper, which is especially noxious to living organisms as a heavy metal. The only survivals derived from the fluid with sediment of 0.01% dilution of Gesagard 50. There were no differences in the rate of daily reproduction between the surviving lines and the controls. It is noted that the formation of chain forms was observed in *P. aurelia* as an effect of Gesagard 50, as well as in one case a heteropolar doublet. The chain forms originate as a result of the inhibitiion of the last phase transversal fission, i.e., of the equatorial constriction. The development of the heteropolar doublet occurred after a surviving paramecium was removed from a 0.01% Gesagard 50 dilution after 48 hr. This paramecium divided twice, producing a doublet and an animal which developed into a correctly dividing line. The doublet form changed after 72 hr into a sort of triplet following further division. This triplet moved incorrectly, in a whorl, in a direction opposite to normal. This form died after 5 days.

76-0738. Stern, P.; Valjevac, K.; Gmaz-Nikulin, E. (Dep. Pharmacol. Pathol., Med. Fac., Univ. Sarajevo, Sarajevo, Yugoslavia). **An attempt at treating progressive muscular dystrophy with DDT.** *Fol. Med. (Sarajevo)* 9: 9-17; 1974. (18 references)

A study was conducted to determine the possible usefulness of DDT in treatment of muscular dystrophy. Artificial muscular dystrophy was induced in male Wistar rats by applying aortic ligature immediately below the branching point of the renal artery. Seven days after the operation all animals were given 3, i.p., 20 mg/kg doses of serotonin, with 48-hr intervals between injections. Experimental animals were treated with daily p.o. doses of DDT dissolved in oil, at either 10 or 25 mg/kg dose levels. DDT treatment at either dose level resulted in statistically significant improvement of muscular function over untreated controls. Dystrophic lesions were distinctively less strong in animals receiving the DDT treatment, regardless of dose level, than in controls. There were cases in which several of the 10 examined view fields of a sample from treated animals showed no sign of necrosis, while in other view fields the number of necrotic fibers was always less than in controls. However, it is noted that the resorptive-proliferating processes did not differ in quality between experimentals and controls. The results of this study are

entirely consistent with the view of progressive muscular dystrophy as a primarily neurologic disorder, caused by a gradually developing and strictly localized impairment of ACh release at certain neuromuscular junctions. It is assumed that reduced ACh release not only interferes with neuromuscular transmission, but also impairs its trophic tasks. It is suggested that an analogy exists between progressive muscular dystrophy and BT-poisoning with respect to impaired ACh release as their common factor.

76-0739. Eisenbrand, G.; Ivankovic, S.; Preussmann, R.; Schmahl, D.; Wiessler, M. (German Cancer Res. Cent., Inst. Toxicol. Chemother., D-69, Heidelberg, Germany). **Some recent results on the chemistry, formation, and biological activity of *N*-nitroso compounds.** *GANN Monograph Cancer Res.* 17: 133-143; 1975. (32 references)

The metabolism of various substances was studied under conditions simulating those found in the stomach. The substances examined included some fungicides derived from dithiocarbamic acid, such as ziram, ferbam, and DPTD. The former two compounds produced dimethylnitrosamine and the latter compound produced *N*-nitrosopyrrolidine under conditions found in the stomach. Studies were also made of the insecticides carbaryl and propoxur and the herbicides benzthiazuron, simazin, and atrazin All pesticides formed *N*-nitroso products under stomach conditions. The triazine herbicides formed the mononitroso compounds almost exclusively. *N*-nitrosobenzthiazuron, *N*-nitrosopropoxur, and *N*-nitrosocarbaryl showed considerable genetic activity. *N*-nitrosobenzthiazuron was a potent carcinogen in rats. The results of this study indicate that pesticides with structures susceptible to *N*-nitrosation can be nitrosated at relatively low concentrations directly in the stomach. The resulting *N*-nitroso compounds are highly active compounds displaying strong genetic and carcinogenic effects. In experiments with prenatal exposure to nitrosoureas, the main tumor location was found to be the nervous system. This preferential induction of neurogenic tumors by chemical carcinogens active in prenatal tumor induction indicates a high sensitivity towards carcinogenesis of neurogenic tissue during prenatal development. The widespread presence of nitroso compounds in our environment and the fact that these compounds are taken in with food as well as formed in the stomach from precursors requires special attention to potential carcinogenic hazards in man. Evidence is presented to suggest that even minimum doses of nitrosamines suffice to cause cancer in man. It is suggested that the removal of such compounds from the environment and the prevention of their formation in the human body would be an important step towards an effective cancer prophylaxis.

76-0740. Kiryushin, V. A. (Ryazan I. P. Pavlov Med. Inst., USSR). **Mutagennoe deystvie razlichnykh pestitsidov pri ikh posledovatel'nom postuplenii v organizm belykh krys.** [**Mutagenic action of various pesticides in case of their successive entry into the body of albino rats.**] *Gig. Sanit.* 9: 43-46; 1975. (7 references) (Russian)

Male mice were fed 1/15 and 1/200 of LD50 doses of nitrophen and zineb alone, or binary mixtures of zineb with trichlorfon, metaphos, carbophos, or ether sulfonate in 6-day cycles with 6 to 27 day intermissions between two consecutive cycles to determine the mutagenic action of these pesticides and their combination by chromosome analysis in bone marrow cells. While nitrophen alone caused no chromosomal aberrations, both zineb and its binary mixtures with trichlorfon, metaphos, carbophos, and ether sulfonate caused significantly increased frequency of chromosomal aberrations, which was higher in animals treated with binary mixtures than in those treated with zineb alone. Mixtures of zineb with trichlorfon and ether sulfonate had more powerful mutagenic effect than mixtures of zineb with carbophos and metaphos. A linear dose-effect relationship was established. A 10-day intermission between the 6-day poisoning cycles was sufficient for the recovery of the damaged chromosomes, which was indicated by the reduction of the aberration frequency to the spontaneous mutagenesis level. Gaps and chromatid breaks were the dominant types of the chromosomal aberrations, while isochromatid breaks and translocations were rare. The aneuploidy was between 2 and 5 both in the experimental and in the control groups.

76-0741. Yurovskaya, E. M. (Kiev A. N. Marzeev Sci. Res. Inst. General Communal Hyg., USSR). **Povedenie patogennykh i sanitarno-pokazatel'nykh bakteriy v usloviyakh zagryazneniya vodoemov forsororganicheskimi pestitsidami.** [**Behavior or pathogenic and hygienic indicator bacteria in surface waters containing organophosphorus pesticides.**] *Gig. Sanit.* 9: 102-103; 1975. (Russian)

The effect of trichlorfon, metaphos, carbophos, and their mixtures was studied on the behavior and population kinetics of hygienic indicator microorganisms (*Escherichia coli* and *Entercocci*), and on other pathogenic microorganisms in water. The pesticides did not cause any changes in the behavior and population kinetics of *E. coli*, *Enterococci*, dysentery bacteria, fecal *Streptococci*, *Shigelia*, and *Salmonella* A and B at 5-6°C and 20-22°C water temperature when they were present in the maximum allowable concentration or in a tenfold concentration. At a water temperature of 20-22°C, trichlorfon, present in 1 g/liter concentration in river water, inhibited the growth of *E. coli*, fecal *Streptococci*, *Shigelia*, and *Salmonella* A and B. The identical behavior of indicator microorganisms and pathogenic microorganisms indicates the suitability of the common indicators even in pesticide-contaminated water.

76-0742. Linyuchev, M. N.; Mima, Yu. P.; Sergeev, V. V. (S. M. Kirov Military Medical Academy, Leningrad, USSR). **Vliyanie fenobarbitala na toksichnost' i antikholinesteraznuyu aktivnost' tetraetilpirofosfata.** [**Effect**

of phenobarbital on the toxicity and anticholinesterase activity of tetraethylpyrophosphate.] *Gig. Sanit.* 9: 118; 1975. (Russian)

The effect of phenobarbital and enzyme SGT-1201 on the toxicity and cholinesterase-inhibiting action of tetraethyl pyrophosphate (TEPP) was studied in male albino mice. Three daily i.p. phenobarbital doses of 14 mg/kg increased the tolerance of the mice for s.c. and i.p. administered TEPP by 1.17 times, for p.o. administered TEPP by 1.6 times. In untreated mice, the LD50 of TEPP was 0.588 mg/kg when administered s.c.; 1.41 mg/kg when administered i.p., and 3.69 mg/kg when administered p.o. Pretreatment with i.p. 10 mg/kg SGT-1201 reduced the p.o. LD50 of TEPP, and it reduced the TEPP-tolerance-increasing effect of phenobarbital. Pretreatment with phenobarbital decreased the cholinesterase-inhibiting effect of TEPP.

76-0743. Gabovich, R. D.; Murashko, V. A. (Medical Inst., Kiev, USSR). **Deystvie metilmerkaptofosa pri razlichnykh sochetaniyakh povyshennoy temperatury vozdukha i ul'trafioletovogo oblucheniya.** [**Effect of methylmercaptophos under the conditions of elevated air temperature and UV radiation.**] *Gig. Tr. Prof. Zabol.* 9: 52-53; 1975. (Russian)

The effect of different combinations of elevated air temperature (35°C) and UV radiation on the toxicity of methylmercaptophos was studied in adult male rats in 3-month experiments. The animals were exposed to a methylmercaptophos concentration of 3 mg/m^3 in the air for 4 hr daily. The chronic toxicity of methylmercaptophos was evaluated on the basis of changes of the following biochemical and physiological parameters: serum alkaline phosphatase activity, hepatic and serum cholinesterase activity, gas exchange intensity, ascorbic acid level in the adrenal gland, supravital staining of liver and brain tissues, and gain in weight. The findings indicate that the resistance of the organism to methylmercaptophos was reduced by suboptimal UV radiation (1/30 of the optimal dose), high temperature, and by the combination; and hypererythemal UV dose (5 × optimal dose). Optimal UV radiation increased the resistance of the organism to methylmercaptophos both at normal and at elevated temperature. The findings should be considered in the planning of occupational prophylactic measures and in hygienic standardization.

76-0744. Yakushko, V. E.; Zlatev, Z. D. (Inst. Hyg.,Toxicol. Pesticides, Polymers, Plastics, Kiev, USSR). **Toksichnost' nekotorykh akaritsidov i izmenenie aktivnosti aminopiridindemetilazy microsom pecheni v usloviyakh kombinirovannogo i razdel'nogo primeneniya.** [**Toxicity of certain acaricides and changes in the activity of hepatic microsomal aminopyridine demethylase during combined and separate application.**] *Gig. Tr. Prof. Zabol.* 9: 55-57; 1975. (2 references) (Russian)

The acute oral toxicity of binary mixtures of kelthane, milbex, and acrex with phthalophos, phosalone, dimethoate, and anthio, respectively, and the effect of milex, phosalone, and their combination on the hepatic microsomal aminopyridine demethylase activity were studied in albino mice and rats. The organochlorine and organophosphorus preparations were mixed at 2:1 ratio. While mixtures of kelthane and acrex with phthalophos and dimethoate, respectively, showed summation effect, judged from the LD50 value, all other combinations showed antagonistic effect. Phosalone, administered in 1/5 of LD50 dose for 3 consecutive days, increased the hepatic microsomal aminopyridine demethylase activity by a factor of 2 against the control, and milbex caused an increase by 3.8 times. The mixture of these two pesticides increased the enzyme activity by 7.4 times.

76-0745. Litau, V. G. (Author address not given). **Materialy k kharakteristike kozhno-rezorbtivnogo deystviya trikrezilfosfata v smesi s efirom adipinovoy kisloty.** [**Data for the characterizaion of the skin resorption of tricresylphosphate in mixture with adipic acid.**] *Gig. Tr. Prof. Zabol.* 9: 58-59; 1975. (7 references) (Russian)

The resorption of 4% technical tricresylphosphate alone and mixed with m-methylcyclohexyl-2-ethylhexyl adipate through the intact skin was studied in male albino mice after 4 hr contact time, and in guinea pigs after 30-day contact. The 4-hr-contact caused no visible skin alterations, but the treated animals showed motor depression and dull reflex on pain. Six of the 20 animals treated with the mixture died within 2-3 days. The serum cholinesterase activity was reduced in animals treated with tricresylphosphate or with mixtures containing this substance. After 30-day contact on guinea pigs, motor coordination and gastrointestinal disturbances, reduced gain in weight, reduced cholinesterase activity, skin desquamation, thickening of the skin and of the basal and keratic layers, enlargement of the hair bulbs, round-cell infiltration, and edema of the dermis on the application site were observed. The findings indicate the resorptive effect of tricresylphosphate and contact dermatitis even in its mixtures with adipic acid.

76-0746. Bhattacharya, S.; Mukherjee, S.; Bhattacharya, S. (Dep. Zool., Visva-Bharati Univ., Santiniketan, India). **Toxic effects of endrin on hepatopancreas of the Teleost fish, *Clarias batrachus* (Linn.).** *Indian J. Exp. Biol.* 13: 185-186; 1975. (14 references)

An attempt was made to correlate the concentration of endrin with histopathological changes and altered α-amylase activity and to determine the 48 hr LC50 of endrin to *Clarias batrachus* (Linn.). During this study various concentrations of endrin were used: 0.001, 0.003, 0.005, 0.008, 0.0095, and 0.011 ppm. The 48 hr LD50 of endrin was 0.005 ppm. For histological studies, the hepatopancreas was removed and exposed to endrin for 48 hr. The changes were characterized by swollen liver cells, liver cord disarray and surface irregularities. Binucleated

hepatic cells and cells with a greatly enlarged nucleus were occasionally present. Degenerative changes were noted by the presence of ruptured and vacuolized hepatic cells, sometimes also the appearance of intercellular spaces which indicated a severe necrotic condition. These changes were proportionally greater in fish exposed to higher concentrations of endrin. α-Amylase activity in the hepatopancreas exposed to 0.005 ppm endrin for 48 hr was inhibited by 66%. Recovery of enzyme activity occurred when fish exposed to 0.005 ppm endrin were placed in fresh water for about 72 hr. It is suggested that the restoration of the α-amylase activity in LC50 endrin exposed fish transferred to fresh water may be due to gradual regeneration of hepatopancreas tissue.

76-0747. Thigpen, J. E.; Faith, R. E.; McConnell, E. E.; Moore, J. A. (Natl. Inst. Environ. Health Sci., Research Triangle Park, NC 27709). **Increased susceptibility to bacterial infection as a sequela of exposure to 2,3,7,8-tetrachlorodibenzo-*p*-dioxin.** *Infect. Immun.* 12(6): 1319-1324; 1975. (33 references)

This report describes the effects of subclinical levels of 2,3,7,8- tetrachlorodibenzo-*p*-dioxin (TCDD) on the response of male C57BL/6Jfh mice to infection with either *Salmonella bern* or *Herpesvirus suis*, also known as pseudorabies virus. TCDD appears as a contaminant of certain commercially useful chemicals, such as chlorinated phenols or herbicides. It causes thymic atrophy and suppresses cell-mediated immunity in lab animals. In this study sublethal levels of TCDD, 0.5, 1, 5, 10, or 20 μg/kg, were given through a stomach tube once weekly for 4 weeks. There was a significant decrease in weight gain for mice receiving the 20 μg dose. Significant increases in mortality and decreases in the time from infection to death were noted in mice receiving doses of 1 μg or more, followed by salmonella infection. However, no effect was noted by giving TCDD to pseudorabies-infected mice. It is suggested that the most important finding of this study was that extremely low levels of TCDD, while they do not produce clinical or pathological change, still have the capacity to affect host defense.

76-0748. Ottaviani, M.; Falleni, M. (Ist. Superiore di Sanita, Rome, Italy). **Influenza degli insetticidi fosforati nella determinazione della domanda biochimica di ossigeno (BOD). [Effect of some organophosphorus insecticides on the determination of biochemical oxygen demand (BOD).]** *Ingegnere* 9: 345-351; 1975. (14 references) (Italian)

Two factors must be taken into consideration when trying to determine if pesticides in water affect the BOD determination. The first relates to the extent of hydrolysis of the insecticide. Errors in measuring the BOD, due to the pressure of the pesticide in the water body, will be related to the extent of hydrolysis, in other words, the time the pesticide has remained in the water prior to sampling. The second consideration concerns the insecticide concentration. The damage to bacterial fauna is proportional to concentration up to a certain level, beyond which effects on the BOD remain unchanged. Interference refers to interference in the study and not to disruption of the environmental biochemical equilibrium.

76-0749. Wargo, J. P.; Honeycutt, R. C.; Adler, I. L. (Res. Lab., Rohm and Haas Co., Bristol, PA 19007). **Characterization of bound residues of nitrofen in cereal grains.** *J. Agric. Food Chem.* 23(6): 1095-1097; 1975. (6 references)

Studies were undertaken to determine whether starch isolated from grain of wheat and rice crops treated with nitrophen-^{14}C contained radioactivity and whether the radioactivity was incorporated into the natural metabolic pool. Starch was isolated from wheat and rice grain and radioassayed by combustion followed by liquid scintillation counting. The study indicated that about 64-96% of the radioactive residues in nitrofen treated wheat or rice grain are in the starch 110 and 147 days, respectively, after planting and treatment. The data from this study leads to the conclusion that the carbon atoms of nitrofen are channeled through at least 3 structural reorganizations during the metabolism of nitrofen to glucose. First, there must be a cleavage of the diphenyl ether bond during this process. A second major occurrence appears to be ring opening leading to glucose or simpler, presumably aliphatic moieties. Finally, a third anabolic process must take place to convert these ^{14}C-containing materials to glucose and finally to starch.

76-0750. Honeycutt, R. C.; Adler, I. L. (Res. Labs., Rohm and Haas Co., Bristol, PA 19007). **Characterization of bound residues of nitrofen in rice and wheat straw.** *J. Agric. Food Chem.* 23(6): 1097-1101; 1975. (12 references)

A study was performed to determine whether cellulose isolated from nitrofen-^{14}C treated rice and wheat plants might contain radioactivity. Rice straw samples were from 2 small plots which had been sprayed preemergence or postemergence with nitrofen-^{14}C labeled uniformly in the dichlorophenyl ring. The straw samples from preemergence treatment were harvested 147 days after treatment and contained residues of 0.12 ppm calculated as nitrofen. The postemergence treated straw samples were harvested 147 days after planting, 96 days after treatment, and contained radioactive residues of 1.91 ppm calculated as nitrofen. Wheat straw samples were from two small plots treated preemergence with nitrofen-^{14}C labeled either uniformly in the nitrophenyl ring or in the dichlorophenyl ring. The straw samples were harvested 110 days after planting and treatment and contained residues of 1 ppm calculated as nitrofen. The results of this study showed that rice and wheat could metabolize nitrofen-^{14}C in such a way as to produce a lignin fraction containing radioactivity. This association is either in the form of a lignin-nitrofen conjugate or as an integral part of one or more of the molecules which comprise the lignin. No species variation was noted with respect to the percen-

tage of radioactive residue associated with the lignin, and the position of the ^{14}C label in the nitrofen molecule did not alter the percentage of radioactive residue associated with lignin. Wheat and rice metabolized nitrofen-^{14}C to cellulose to only a limited degree. Only preemergence nitrofen treated rice straw incorporated significant amounts of nitrofen into cellulose. It appears that the flow of carbon prefers a path from nitrofen-^{14}C into a starch of grain rather than into the cellulose of wheat or rice straw as the plants are maturing. It is suggested that nitrofen goes through 3 major metabolic changes after being applied. First, there is cleavage of the diphenyl ether bond, followed by catabolism which includes a benzene ring opening, and finally reorganization of the carbon atoms into glucose, starch, or cellulose.

76-0751. Juengst, F. W., Jr.; Alexander, M. (Calor Agric. Res., Okemos, MI 48864). **Conversion of 1,1,1-trichloro-2,2-bis(*p*-chlorophenyl)ethane (DDT) to water-soluble products by microorganisms.** *J. Agric. Food Chem.* 24(1): 111-115; 1976. (20 references)

Forty-three percent of the bacteria isolated from sea water and marine sediments converted between 5 and 10% of the DDT supplied in vitro to water-soluble products, and 35% transformed less than 5% of the insecticide to water-soluble metabolites. Several water-soluble compounds generated from DDT by *Mucor alternans* were partially characterized and were found to be different from known products of DDT metabolism. However, the insecticide was not converted to water-soluble products in model marine ecosystems supplemented with a large number of organic compounds and incubated aerobically, anaerobically, and with supplemental inorganic nutrients. (Author abstract by permission)

76-0752. Jones, A. S. (USDA For. Serv., Southeastern For. Exp. Stn., For. Sci. Lab., Research Triangle Park, NC 27709). **Metabolism of aldicarb by five soil fungi.** *J. Agric. Food Chem.* 24(1): 115-117; 1976. (11 references)

Pure cultures of five common soil fungi grown in Czapek-Dox Broth were tested for degradation of aldicarb, and three of the five were tested against aldicarb sulfoxide, the major toxic metabolite. The fungi were, in decreasing order of their effectiveness in degrading the pesticide: *Gliocladium catenulatum* > *Penicillium multicolor* + *Cunninghamella elegans* > *Rhizoctonia* sp. > *Trichoderma harzianum*. Although there was considerable variability among the fungi in the amounts of organo- and water-soluble products from both aldicarb and aldicarb sulfoxide, the major organosoluble metabolites were aldicarb sulfoxide and the oxime and nitrile sulfoxides, with much smaller amounts of the sulfones. Aldicarb was stable under sterile conditions, but some breakdown of aldicarb sulfoxide was found in sterile media after the 28-day incubation. (Author abstract by permission)

76-0753. Hoagland, R. E.; Frear, D. S. (Southern Weed Sci. Lab., Agric. Res. Serv., U.S. Dep. Agric., Stoneville, MS 38776). **Behavior and fate of ethylenethiourea in plants.** *J. Agric. Food Chem.* 24(1): 129-133; 1976. (21 references)

When young seedlings and excised leaves of corn, lettuce, pepper, and tomato were pulse-treated with [4,5-^{14}C]ethylenethiourea (ETU), the labeled ETU was readily absorbed by either the roots or the petioles of excised leaves and was translocated primarily via the xylem. After 20 days, only 1 to 2% of the initial dose remained as [^{14}C]ETU, but several degradation and/or metabolic products were present in the methanol-soluble extracts, and part of the ^{14}C was found in the methanol-insoluble residue. Methanol-soluble and -insoluble degradation products were determined in the various tissue sections for a period of 20 days after treatment. Only minor amounts of $^{14}CO_2$ were obtained from treated plants or excised leaves, but a major degradation product was isolated from pepper plants and was tentatively identified by infrared and mass spectroscopy as ethyleneurea (EU), the oxygen analog of ETU. (Author abstract by permission)

76-0754. Bunyan, P. J.; Jennings, D. M.* (Pest Infest. Control Lab., Minist. Agric., Fish. Food, Tolworth, Surbiton, Surrey, England). **Carbamate poisoning. Effect of certain carbamate pesticides on esterase levels in the pheasant (*Phasianius colchicus*) and pigeon (*Columba livia*).** *J. Agric. Food Chem.* 24(1): 136-143; 1976. (27 references)

Pheasants and pigeons were fed with lethal and sublethal doses of six widely used carbamates. Esterase levels were measured quantitatively in liver and brain and also by an electrophoretic method involving histochemical staining. It is suggested that the inhibition of esterase levels demonstrated by the quantitative measurement and the apparent elevation in esterase levels revealed by the electrophoretic method can be used to diagnose poisoning in birds with these compounds. (Author abstract by permission)

76-0755. Bull, D. L.; Ivie, G. W. (Cotton Insects Res. Lab., U.S. Dep. Agric., College Station, TX 77840). **Metabolism of *O*-ethyl *O*-[4-(methylthio)phenyl] *S*-propyl phosphorodithioate (BAY NTN 9306) by white rats.** *J. Agric. Food Chem.* 24(1): 143-146; 1976. (2 references)

A 10 mg/kg dose of phenyl-^{14}C-labeled BAY NTN 9306 (*O*-ethyl *O*-[4-(methylthio)phenyl] *S*-propyl phosphorodithioate), administered orally to female white rats, was metabolized rapidly and excreted primarily in the urine (ca. 92% in 24 hr). No $^{14}CO_2$ was detected and essentially all the radioactivity in urine consisted of water-soluble materials that were converted to three substituted free phenolic derivatives by hydrolysis with glucuronidase-aryl sulfatase or acid. Analyses of tissues taken from rats 3 hr after treatment with an oral dose of 70

mg/kg revealed the presence of BAY NTN 9306, five phosphorus-containing metabolites formed by oxidations of thiono and thioether sulfur groups of the molecule, and three substituted phenols, both free and conjugated. (Author abstract by permission)

76-0756. Ivie, G. W.; Bull, D. L.; Witzel, D. A. (Vet. Toxicol. Entomol. Res. Lab., Agric. Res. Serv., U.S. Dep. Agric., College Station TX 77840). **Metabolic fate of *O*-ethyl *O*-[4-(methylthio)phenyl-^{14}C] *S*-propyl phosphorodithioate (BAY NTN 9306) in a lactating cow.** *J. Agric. Food Chem.* 24(1): 147-151; 1976. (1 reference)

A lactating Jersey cow was treated orally with *O*-ethyl *O*-[4- (methylthio)phenyl-^{14}C] *S*-propyl phosphorodithioate (BAY NTN 9306) at 0.12 mg/kg as a single oral dose. The administered radiocarbon was essentially quantitatively excreted during a 6-day posttreatment period; about 90% of the dose appeared in urine, about 0.1% in milk, and the rest in feces. Ten days after the first treatment, the animal was treated again with the radiochemical at 0.62 mg/kg. Twelve hours later, when radiocarbon residues in the blood were maximal, the cow was sacrificed, and tissue and digestive tract content samples were analyzed for metabolites. TLC studies indicated that metabolism of this insecticide by the cow involved oxidation of the methylthio sulfur to sulfoxide and sulfone derivatives and hydrolysis of the phosphorus *O*-phenyl ester to give phenolic metabolites that were excreted primarily in the urine in conjugated form. The low residues secreted into milk were also primarily conjugated phenols. (Author abstract by permission)

76-0757. Benezet, H. J.; Knowles, C. O.* (Dep. Entomol., Univ. Missouri, Columbia, MO 67201). ***N'*-(4-chloro-*o*-tolyl)-*N*-methylformamidine (demethyl chlordimeform) metabolism in the rat.** *J. Agric. Food Chem.* 24(1): 152-154; 1976. (12 references)

N'-(4-Chloro-*o*-tolyl)-*N*-methylformamidine-^{14}C was rapidly metabolized and eliminated when administered orally to rats. Excretion balance data indicated that during the 72-hr experimental period the majority of the radioactive materials were eliminated in the feces (64%) but significant amounts also were eliminated in the urine (35%). Radioactive compounds identified in the urine and feces included demethylchlordimeform, 4'-chloro-*o*-toluidine,5-chloroanthranilic acid, and *N*-formyl-5-chloroanthranilic acid. Several unidentified polar metabolites, presumably conjugates, also were present. A new formamidine metabolite, *N*-(4-chloro-*o*-tolyl)formamidine, was tentatively identified from rat urine and feces. Levels of radioactivity in tissues examined were in the parts per billion range. (Author abstract by permission)

76-0758. Hangartner, W. W.; Suchy, M.*; Wipf, H. K.; Zurflueh, R. C. (Dr. R. MAAG Ltd., Biol. Lab., Dielsdorf, Switzerland). **Synthesis and laboratory and field evaluation of a new, highly active and stable insect growth regulator.** *J. Agric. Food Chem.* 24(1): 169-175; 1976. (33 references)

The insect growth regulator 6,7-epoxy-1-(*p*-ethylphenoxy)-3-ethyl- 7-methylnonane (Ro 10-3108) is an efficient agent for plant protection. Stability studies in the laboratory (uv, hydrolysis) and persistency studies outdoors show that this compound, in contrast to most known insect growth regulators, is sufficiently stable for practical purposes. Ro 10-3108 gave good control of natural populations of summerfruit tortrix moth and scale insects. The favorable toxicological data as well as the biodegradability of Ro 10-3108 make this compound a promising candidate for several fields of application. A technically feasible synthesis of the compound is given. (Author abstract by permission)

76-0759. Jackson, C., Jr.; Lindahl, I. L.; Reynolds, P.; Sidwell, G. M. (U.S. Dep. Agric., Beltsville, MD 20705). **Effects of methoxychlor and malathion on semen characteristics of rams.** *J. Anim. Sci.* 40(3): 514-517; 1975. (10 references)

Ten-mo-old Hampshire rams were maintained for 11 mo on ground pelleted alfalfa hay to which methoxychlor (200 or 1,000 ppm) or malathion (270 or 1,350 ppm) had been added. Controls were fed the basic ration only. The average insecticide levels in the spiked feeds were 178 and 873 ppm for methoxychlor and 192 and 941 ppm for malathion. The semen characteristics and spermatozoan morphology of animals were assessed after 0, 3, 6, and 11 mo of treatment. Except for an apparent increase in the percentage of dead tailless spermatozoa in the rams receiving the higher dosage of methoxychlor, the pesticides were without apparent effect on the volume or pH of the semen or on the motility, concentration, or morphology of the spermatozoa. The biological significance of the increased numbers of dead tailless spermatozoa is unknown. The results suggest that rams may consume malathion or methoxychlor at several multiplicities of the respective tolerances on hay for a prolonged period of time without an appreciable effect on their reproductive integrity.

76-0760. Mukuno, K.; Ishikawa, S.; Uga, S. (Dep. Ophthalmol., Kitasa Univ. Sch. Med., Sagamihara, Japan). **An electron microscopic study of the extraocular muscles, optic nerve and sural nerve in experimental chronic organophosphate intoxication.** *J. Clin. Electron Microsc.* 6(3-4): 254-255; 1973. (3 references)

To elucidate the clinical features and mechanisms of visual loss, disturbances of ocular movement and ataxia attributed to organophosphate insecticide toxicity, a long-term experimental study of chronic organophosphate poisoning was performed using beagle dogs. Ethylthiometon (0.5-1.5 mg/kg/day p.o.) was administered for 2 yr. The following morphological changes were noted. In the extraocular muscles the myelinated nerve occasionally

showed demyelination and double-laminated separation of the sheath. In the motor end plate, junctional folds became irregular and bullous. Mitochondria in soleplate became smaller and sparse. Selective swelling of mitochondria and vacuolation in the muscle fiber were found occasionally. In all treated dogs the nerve fibers of the optic nerve decreased in number and spetal tissue increased in amount. Nerve bundles became smaller and increased in number. In the sural and sciatic nerves the myelin sheath swelled markedly and the fibers were reduced in number, especially in the sural nerve. Ethylthiometon induced neuromyopathy in extraocular muscles, optic neuropathy, and peripheral neuropathy in sciatic and sural nerves. On the results of this study it is suggested that ethylthiometon may act as both an irreversible anti-ChE and a direct toxic agent to myelin sheath.

76-0761. Watanabe, P. G.; Sharma, R. P. (Dep. Vet. Sci., Utah State Univ., Logan, UT 84322). **Neurotoxicity of organophosphates: effects of tri- *o*- tolyl phosphate in chick ganglia cell cultures.** *J. Comp. Pathol.* 85(3): 373-381; 1975. (18 references)

A mixed cell nerve tissue culture system from the dorsal root ganglia of chick embryos was used to test the neurotoxic effects of tri-*o*-tolyl phosphate (TOTP, TOCP), its metabolites, and di-isopropylphosphorofluoridate (DFP). The chemicals were added to the culture systems in concentrations of 3 m*M* to 1 μM, and the nerve fibers and neuroglia were examined by phase contrast microscopy 3 and 5 days after addition of the test compounds. Cytotoxic responses consisted of a reduction in the number and length of the nerve fibers and increased vacuolization of the neuroglial cells. Unmetabolized TOTP produced degenerative changes in both nerve fibers and neuroglial cells, metabolized TOTP and DFP being slightly more potent than unmetabolized TOTP. The nerve fibers were generally more sensitive to all treatments than the neuroglial cells. The data demonstrates the value of chick dorsal root ganglia cultures as models for the evaluation of neurotoxic organophosphorus compounds.

76-0762. Ivey, M. C.; Kunz, S. E.; Mann, H. D. (U.S. Livestock Insects Lab., Kerrville, TX 78028). **Ethion, ethion monooxon, and ethion dioxon: residues in the body tissues of turkeys confined in pens on treated soil.** *J. Econ. Entomol.* 68(3): 353-354; 1975. (3 references)

When turkeys were confined in pens on soil sprayed with an emulsion of ethion (4 lb/gal EC) at a rate of 4, 12, and 40 lb AI/acre (4.48, 13.4, and 44.8 kg/ha), maximum residues found in fat and skin, respectively, at 1 wk posttreatment were 0.022 and 0.080 ppm for 4 lb/acre, 0.031 and 0.410 ppm for 12 lb/acre, and 0.295 and 0.666 ppm for 40 lb/acre. Small (0.002-0.003 ppm) residues of ethion monooxon were detected at 1-3 wk posttreatment in the skin of turkeys at a rate of 40 lb/acre, but no ethion dioxon was detected in any tissue. (Author abstract by permission)

76-0763. Zettler, J. L. (Stored-Prod. Insects Res. Develop. Lab., Agric. Res. Serv., USDA, Savannah, GA 31403). **Esterases in a malathion-susceptible and a malathion-resistant strain of *Plodia interpunctella*.** *J. Ga. Entomol. Soc.* 9(4): 207-213; 1974. (25 references)

Larval homogenates of a malathion-susceptible (S) and a malathion-resistant (R) strain of the Indian meal moth, *Plodia interpunctella* (Hubner), were assayed electrophoretically and titrimetrically against selected substrates for esterase activity. Twelve of the general protein bands in the R and S homogenates were quite similar, but there were two bands in each homogenate that were not present in the other. The α-naphthyl acetate esterase bands showed more diversity. The R homogenates were characterized by 13 bands compared with only nine for the S homogenates. In addition, the R strain contained significantly less carboxylesterase and butyrylcholinesterase than the S strain, although the acetylcholinesterase activities did not differ significantly between the two strains. The results indicate that resistance to malathion in *P. interpunctella* is probably generalized and is not specific for this pesticide.

76-0764. Kovaleva, E. S.; Talanov, G. A. (All-Union Sci. Res. Inst. Vet. Hyg., USSR). **Metabolizm geptakhlora i dinamika ego ostatkov v pochve i rasteniyakh. [Heptachlor metabolism and dynamics of its residues in soil and plants.]** *Khim. Sel'sk. Khoz.* 13(9): 69-72; 1975. (14 references) (Russian)

The metabolism and residue dynamics of heptachlor were studied in corn, sunflower, potato, sugarbeet, vetch and oat plants, in soil, and in rabbits. Very rapid degradation of heptachlor was observed in plants treated with aqueous emulsion of heptachlor at rates of 1.5-3 kg/ha. An unidentified metabolite, similar to heptachlor epoxide, which is possibly further metabolized to heptachlor epoxide, was also found in plant and soil samples. This metabolite was degraded more slowly than heptachlor. Heptachlor epoxide residues not exceeding 0.1 mg/kg were found in certain plant samples, but not in the soil. Very rapid metabolism of heptachlor to heptachlor epoxide was observed in rabbits. Both heptachlor and its unidentified metabolite were absorbed by plants from the soil. The unidentified metabolite was also present in the technical preparation.

76-0765. Borzsonyi, M.; Sipos, V.; Csik, M. (Dep. Morphology, National Inst. Public Health, Budapest, Hungary). **In vivo keletkezett *N*-nitroso vegyulettel inducalt malignus lymphomak egerekben. [Malignant lymphomas in mice induced by in vivo produced *N*-nitroso compounds.]** *Magy. Onkol.* 19(3): 175-184; 1975. (36 references) (Hungarian)

Swiss line mice received 2 × 250 mg/kg/week doses of methyl-2-benzimidazole carbamate (MBC) intragastrically, and drinking-water with 0.5% sodium nitrite in an experiment on the carcinogenic effect of *N*-nitroso com-

pounds produced in vivo. Lymphosarcomas developed in 10/30 animals between the 82nd and 164th days of the experiment. The thymus was involved in all cases. Splenomegalia, hepatomegalia, and involvement of the liver, spleen, kidneys, and, in one case, also of the lung were observed. Intracytoplasmatic A RNA virus was detected by electron microscopy. The offspring in mice treated during pregnancy showed no developmental anomalies, but later they developed lymphosarcomas. No tumors were found in mice treated with MBC or sodium nitrite-containing water alone. The tumor incidence in the untreated control was 3/116. The findings emphasize the possibility of in vivo formation of carcinogenic *N*-nitroso compounds from MBC (carbendazim).

76-0766. Pollini, G.; Biscaldi, G. P. (Ist. Med. Lavoro Univ. di Pavia, Milan, Italy). **Sulla possibile azione leucemogena delle sostanze chimiche di uso industriale. [The possible leukemogenic action of industrial chemical substances.]** *Med. Lav.* 64(3-4): 121-126; 1973. (21 references) (Italian)

Definite leukemogenic action has been determined for benzene, ionizing radiation, and probably hexachlorocyclohexane. However, substances toxic to the hemopoietic system are not necessarily leukemogenic. Furthermore, substances which are definitely carcinogenic are not necessarily leukemogenic. The sporadic manifestations of leukosis, whether spontaneous or experimentally induced by these carcinogenic substances, only represent an epiphenomenon of a dysplastic nature in the intoxicated organism. In benzene hemopathy, the terminal leukemic stage is preceded by a pre-leukemic period which can last for various lengths of time and which is characterized by the presence of serious dysplastic symptoms in the hemopoietic cells during mitosis and interkinesis. Two possible pathological interpretations of benzene leukosis are presented: it can be viewed as a cellular illness caused by the dominance of an abnormal group of cells altered by a somatic mutation induced by the benzol; it can also be viewed as the expression of a serious cytoproductive incapacity of the marrow without any necessary implication of neoplastic illness.

76-0767. Zhuravleva, I. A.; Krasnova, S. N. (E. I. Martsinovskiy Inst. Med. Parasitol. Tropical Med., Moscow, USSR). **Tormozhenie khlorofosom i ego metabolitom DDVF rasshchepleniya fruktozo-1,6-difosfata v gialoplazme mukh *Musca domestica* L. [Inhibition of fructose-1,6diphosphate cleavage in the hyaloplasm of *Musca domestica* L. by trichlorfon and its metabolite DDVP.]** *Med. Parazitol. Parazit. Bol.* 46(3): 347-351; 1975. (14 references) (Russian)

The inhibition of fructose-1,6-diphosphate cleavage in muscle cell hyaloplasm by trichlorfon and DDVP, and the metabolism of 32P-labeled trichlorfon were studied in a bred strain (ICh-VIII) of houseflies (*Musca domestica* L.). Correlation was established between the inhibition of fructose-1,6-diphosphate cleavage by hyaloplasm enzymes and the in vitro and the concentration of the more toxic trichlorfon metabolite DDVP, as the inhibition was strongest at the time when the DDVP concentration reached its maximum. Trichlorfon, and traces of DDVP were detected in the hyaloplasm already 1 hr after the application of 32P-labeled trichlorfon on live flies by means of a microsyringe. While the trichlorfon concentration in the hyaloplasm showed a rapid decrease, the DDVP concentration reached its maximum by the fourth hour, and remained high for 4 more hours. In seriously poisoned, paralyzed flies, high trichlorfon and DDVP (dichlorvos) levels were found in the hyaloplasm even after 8 hr.

76-0768. Grimes, D. J.; Morrison, S. M. (Dep. Microbiol., Colorado State Univ., Fort Collins, CO 80523). **Bacterial bioconcentration of chlorinated hydrocarbon insecticides from aqueous systems.** *Microb. Ecol.* 2(1): 43-59; 1975. (31 references)

The prevalence of chlorinated hydrocarbon insecticide uptake by chemoorganotrophic bacteria was studied. Thirteen bacterial species sorbed and concentrated α-chlordane, β-chlordane, dieldrin, heptachlor epoxide, and lindane from aqueous systems. Bioconcentration, as expressed by the ratio of cellular insecticide in ng/mg (dry weight) to supernatant insecticide in ng/μl, ranged from 10 for lindane by *Enterobacter aerogenes* to 55,900 for β-chlordane by *Caulobacter vibrioides* var. limonus. The amounts of cellular chlorinated hydrocarbon insecticides (CHI) detected and the bioconcentration ratios decreased in the order chlordane, dieldrin, heptachlor epoxide, lindane. The water solubilities of these CHI decreased in the reverse order. The CHI were not easily removed from the cells by washing and desorption was directly proportional to the water solubility of the insecticide. The uptake of the CHI was rapid, near maximum amounts being sorbed within 15 min. Optimal bioconcentration occurred at pH 7. The data suggests that bioconcentration of CHI by bacteria might serve as a means of introducing these toxic compounds into aquatic food chains and that the bioconcentration phenomenon might be used as a means of removing residual CHI from water supplies and wastewater.

76-0769. Kruglov, Yu. V.; Mikhaylova, E. I. (All-Union Sci. Res. Inst. Agricultural Microbiology, USSR). **Razlozhenie gerbitsida simazina v kul'turakh vodorosley. [Decomposition of herbicide simazine in cultures of algae.]** *Mikrobiologiya* 44(4): 732-735; 1975. (6 references) (Russian)

The accumulation and metabolism of simazine, labeled by ^{14}C in its side chain, was studied in green algae (*Chlorella vulgaris* Beiyer), yellow-green algae (*Chloridella simplex* Pasch.), and in blue-green algae (*Anabaena variabilis* Kuetz., and *Phromidium foveolarum* (mont.) Gom.). The algae were cultured in a medium containing 2 mg/l simazine for one month. The

algae were found to absorb 4.2-18% of the simazine added to the culture medium, and concentrations of 172-480 mg/kg were measured in the algae, which corresponds to a cumulation factor of about 100. The free simazine content, determined by extraction with acetone, was between 15 and 30.4%. No radioactivity was found in pigments. The protein fraction contained up to 28.8% of the simazine absorbed, which indicates the role of proteins and amino acids in the detoxification of simazine. The simazine concentration in the culture medium increased, while the concentration of water-soluble metabolites increased in the course of the experiment. The findings indicate accumulation and partial metabolization of simazine by algae.

76-0770. Raith, L. (Med. Clin. Univ. Monaco, Monte Carlo). **La terapia medica dell'ipersurrenalismo. [Treatment of hyperadrenocorticism.]** *Minerva Med.* 64: 682-684; 1973. (10 references) (Italian)

There are two approaches to medically reducing hypersecretion of cortisol in cases of hyperplasia of the adrenal cortex. Indirect inhibition of cortisol secretion by impeding the accumulation of ACTH (which regulates cortisol synthesis) has not been successful to date. With reference to direct action on the adrenal cortex by substances that block the enzymes which synthesize steroids, metapyrone is the best known compound used. Aminoglutethimide, however, blocks the enzymes much more efficiently because it blocks steroid synthesis in its earliest stages, whereas metapyrone only partially blocks 11-hydroxylase. This substance can also be used in cases of inoperable carcinomas of the adrenal cortex, although in such cases, it is more effective to use *o,p'*-DDD. At a dosage of 3-12 g/day, there is a significant decrease in steroid excretion in 10% of the cases. In only one third of the patients was there a temporary growth arrest of the tumor or a net regression. Medical therapy of adrenal hyperfunction cannot replace total adrenalectomy, even in cases of hyperplasia. Blockage of steroid synthesis prior to surgery is especially justifiable in cases of adrenal adenoma since it can reduce surgical risks. The use of *o,p'*-DDD in inoperable carcinomas can at least reduce discomfort and even prolong life in some cases.

76-0771. Martin, N. A. (Entomol. Div., DSIR, P. B., Auckland, New Zealand). **Effect of four insecticides on the pasture ecosystem. I. Insecticide residues, soil moisture and bulk density, and herbage yield and composition.** *N. Z. J. Agric. Res.* 17(4): 485-494; 1974. (30 references)

Fenitrothion, fensulfothion, carbofuran, and DDT granules were applied at the recommended rate for control of grass grub (2.24 kg a.i./ha) to a flat paddock of Motupiko loam in which primarily ryegrass and clovers were growing. The pasture had been grazed by Romney sheep and, occasionally, Angus-Hereford cattle. Soil samples were taken 7, 20, and 30 weeks after pesticide application and herbage samples were taken 5-17 mo later after 3-4 weeks' growth. Most of the insecticide residues remained in the top 30 mm of the soil. Only a trace of fenitrothion was present in the soil 7 weeks after treatment, whereas some fensulfothion and most of the DDT residues were still present after 30 weeks. The insecticides had no apparent effect on soil moisture or bulk density, or on the yield or species composition of the herbage.

76-0772. Martin, N. A. (Entomol. Div., DSIR, P.B., Auckland, New Zealand). **Effect of four insecticides on the pasture ecosystem. II. The fauna collected in pit traps.** *N. Z. J. Agric. Res.* 18(2): 179-182; 1975. (3 references)

Pit traps were used to compare the fauna of untreated pasture plots with that of plots treated with fensulfothion, fenitrothion, carbofuran, or DDT granules (applied at the recommended rate of 2.24 kg a.i./ha). Samples were collected prior to pesticide treatment and 5-8 and 15-18 days after treatment. Fensulfothion, fenitrothion, and carbofuran were highly toxic to *Sminthurinus* and slightly, but significantly, toxic to other Collembola species, including *Brachystomella parvula*, and various species of *Isotomurus*. DDT was without apparent effect on the Collembola populations. Although the numbers of the soil aphid *Aploneura lentisci* were reduced by carbofuran, the insecticide-induced reductions in the populations of some of the larger insects, harvestmen, and spiders was only slight and no conclusions could be drawn based on the results.

76-0773. Moeed, A. (Ecol. Div., DSIR, Lower Hutt, New Zealand). **Effects of isobenzan, fensulfothion, and diazinon on invertebrates and micro-organisms.** *N. Z. J. Exp. Agric.* 3(2): 181-185; 1975. (9 references)

Fensulfothion, diazinon, and isobenzan were applied in granulated form (5% formulations) at 0.9 kg a.i./0.4 ha to soil plots and the effects of soil invertebrates and microorganisms determined. Of the three pesticides, isobenzan was the most effective in depressing the numbers of invertebrates in the treated soil; the results were statistically significant for Coleoptera, Lumbricidae, and surface arthropods. Fensulfothion was marginally more effective than diazinon, but both provided some control over soil invertebrates. Fensulfothion significantly increased the number of nematodes in the soil, while isobenzan and diazinon significantly increased their number. All three pesticides decreased the number of bacteria, but only fensulfothion had a significant effect. Fungi were significantly affected only by diazinon, which reduced their number, and the effects on algae and protozoa were nonsignificant.

76-0774. Seidler, H.; Macholz, R. M.; Haertig, M.; Kujawa, M.; Engst, R. (Zentralinstitut fuer Ernaehrung, Potsdam-Rehbruecke, DDR). **Untersuchungen ueber den Metabolismus einiger Insektizide und Fungizide in der Ratte. 4. Mitt. Verteilung, Abbau und Ausscheidung von 14-C-markiertem Lindan. [Studies on the metabolism of cer-**

tain insecticides and fungicides in the rat. Part IV. Distribution, degradation, and excretion of carbon-14- labeled lindane.] *Nahrung* 19(5/6): 473-482; 1975. (11 references) (German)

The distribution, degradation, and excretion of ^{14}C-labeled lindane was studied in male Wistar rats over 72 hr after p.o. administration of 90 μg/kg of lindane following adaptation with 8 mg/kg doses for 10 days. The lindane concentrations were highest in fat, kidneys, muscles, pituitary and thyroid glands both after 24 and 72 hr. The hexane extract of fat contained 35.53% of the total radioactivity after 24 hr, and 15.6% after 72 hr. Marked differences were observed in the brain between the cortex, stem, and cerebrum. The metabolite γ-2,3,4,5,6- pentachlorocyclohexane (γ-PCCH) and the sum of the metabolites pentachlorobenzene (PCB) and hexachlorobenzene (HCB) amounted to 1-3% of the hexane extract in certain organs after 24 hr, and to 5-8% after 72 hr. Large amounts of conjugates and strongly polar, hexane-soluble metabolites were present in the feces and urine, but also in organs. The urine and feces contained 8 and 43% of the extractable activity. After 72 hr, the urine and feces contained 35%. Glucuronides accounted for 3% and 8% in the urine and feces after 24 hr, for 18% and 14% after 72 hr. The remainder was unidentified, water-soluble conjugates. The percentage of free lindane in the urine was 1-3%. A total of 3-6% of non-metabolized lindane was excreted. The proportion of γ-PCCH and PCB + HCB in excretions was 0-2.5%. Half of the lindane administered was excreted within 3-4 days.

76-0775. Engst, R.; Macholz, R. M.; Kujawa, M. (Zentralinstitut fuer Ernaehrung, Bereich Fremdstoffe in Nahrung und Ernaerung, Bergholz-Rehbruecke, DDR). **Identifizierung von Metaboliten und der Abbauweg des Hexachlorbenzols in einer Schimmelpilzkultur.** [**The identification of metabolites and the mode of metabolism of hexachlorobenzene in a mold culture.**] *Nahrung* 19(7): 603-606; 1975. (4 references) (German)

The metabolism of BHC in a lindane-decomposing mold culture was studied in a 52-day experiment. The BHC was found to be metabolized by the mold culture at a very low rate, and pentachlorobenzene was identified as the only metabolite. The rate of metabolism of pentachlorobenzene was considerably higher. Pentachlorobenzene, 2,3,4,5-tetrachlorophenol, 2,3,4,6- tetrachlorophenol, 1,2,3,4-tetrachlorobenzene, 1,2,3,5-tetrachlorobenzene, and/or 1,2,4,5-tetrachlorobenzene, 2,3,4-trichlorophenol, 3,4,5-trichlorophenol, and 1,3,5-trichlorobenzene were positively identified as the metabolites of pentachlorophenol. Very small quantities of 3,5-dichlorophenol and 1,2,4-trichlorobenzene were tentatively identified among the metabolites.

76-0776. Dorough, H. W. (Dep. Entomol., Univ. Kentucky, Lexington, KY 40506). **Metabolism of carbamate insecticides.** *Natl. Tech. Inform. Serv.*, PB-231 596, 1973, 255 p. (65 references)

The metabolism was studied of selected carbamate insecticides and certain of their key metabolites. Aldicarb was examined in lactating cows, laying hens, and in boll weevils and houseflies. Carbaryl was studied in lactating cows and in the soil. Carbofuran was studied in houseflies. The effects of other insecticides and certain monoamine oxidase inhibitors on carbaryl metabolism in rats were also studied. Radioactive 3-hydroxycarbofuran was biosynthesized and its metabolism investigated in rats and bean plants. Similar studies were carried out with its glucoside and glucuronide and with 1-naphthol and its glucoside conjugate. A variety of animal species was used to study the mechanisms of glycosylation. The glucosides of 4- and 5-hydroxy carbaryl were prepared chemically and their acute toxicity to mice compared to the aglycones. These studies indicated that carbamate insecticides are metabolized initially by hydrolytic- and oxidative-type reactions with the resulting products being almost totally conjugated. The conjugated products constitute the majority of the terminal residues of carbamates in both animals and plants.

76-0777. Gangstad, E. O.; Zimmerman, P. W.; Hitchcock, A. E.; Kirkpatrick, H., Jr.; Earle, T. T.; McClure, T. T.; Stokes, W. S.; Davis, F. S.; Schultz, D. P.; Barnes, W. W.; Foret, J. A.; Spencer, N. R. **Aquatic-use patterns for 2,4-D dimethylamine and integrated control.** *Natl. Tech. Inform. Serv.*, AD-A002 568, 1974, 143 p. (23 references)

Detailed studies have been performed on the use of 2,4-D for control of water hyacinth. When 2,4-D is used for aquatic plant control, the acute toxicity of the substance is not considered an important biological factor. Chronic or subacute toxicity, 1/4 to 1/10 of the acute toxicity, is not considered a serious problem limiting the use of the herbicide. The major route of detoxification in plants is decarboxylation. The herbicide is rapidly excreted by the animal system. Very minor amounts are found in milk and butter. Little or no accumulation in the food chain takes place. Three days after 2,4-D was used to treat pond water at a rate of 8.96 kg/ha, the residue was 0.345 mg/l. No residues were detected in fish at 3 or 7 days after treatment. In studies using 2,4-D for water hyacinth and water milfoil control, the herbicide was dissipated before reaching water intakes when it had been applied at an approximate distance of one-half mile from the intake. Some results of the studies concerning control of alligator weed in Florida at the Ortega River are discussed. Appendices included in this report are: amine aquatic herbicide; control of water hyacinth; registration of aquatic herbicide; requirements for establishing tolerances for aquatic herbicides; toxicology, persistence, and mobility of phenoxy herbicides with the environment; residue studies of the application of 2,4-dichlorophenoxyacetic acid dimethylamine salt in field ponds in Florida, Georgia, and Missouri; dissipation of 2,4-D in potable water systems; and integrated control of alligator weed.

76-0778. Otto, N. E. (Eng. Res. Cent., Bureau Reclamation, Denver, CO 80225). **Investigations of aquatic weed control methods and their environmental effects on non-target aquatic species: progress report 1972-1973.** *Natl. Tech. Inform. Serv.*, PB-240 191, 1974, 54 p. (31 references)

Diatom and macroinvertebrate animal populations were sampled in 4 irrigation canals, 2 of which were treated with aquatic herbicides for aquatic weed control. The two canals receiving herbicide treatment with copper sulfate and xylene did show some monthly decline in species diversity during application, but recovered rapidly when treatments were stopped. Macroinvertebrate populations were immediately reduced following application of xylene. Within 4 days, however, the treated areas were reinvaded and within 1 month the levels had returned to pretreatment values. Diatoms recovered more slowly. It is noted that the canal treated with xylene was populated with leeches and snails which were not found at other river or canal sites. It is suggested that this condition was probably caused by a response to a mineral nutrient enrichment of the habitat rather than to the effects of herbicide application. From these studies it was concluded that a determination of a taxa diversity index of either diatom or macroinvertebrates is a reasonably accurate method to indicate environmental conditions of canal aquatic habitats that influence biological populations. It is suggested that this technique may be useful as a supplement to chemical and physical analyses of water to ascertain whether herbicides, pesticides, or other contaminants are producing harmful effects on the aquatic habitat.

76-0779. Ghazal, A.; Mahfouz, M.; Makar, A. B. (Dep. Pharmacol., Fac. Pharm., Alexandria Univ., Alexandria, Egypt). **Effect of schistosomal infection and of schistosomicidal drugs on the drug metabolizing enzymes of mouse liver.** *Naunyn-Schmiedeberg's Arch. Pharmacol.* 282: 181-186; 1974. (18 references)

Schistosomal infection in mice caused an inhibition of the hepatic drug metabolizing enzyme activities. The magnitude of inhibition was not the same for all enzyme activities measured. MMAA and paraoxon metabolizing activities were strongly inhibited, whereas hexobarbital and aniline metabolizing activities were only moderately affected. Treatment of infected mice with schistosomicidal drugs produced a dramatic reversal of the inhibition in cases of MMAA and paraoxon metabolizing enzymes, the 2 activities mostly affected by schistosomal infection. On the other hand, the reversal of inhibition was not statistically significant in the other 2 enzyme activities. Comparing the effectiveness of the different schistosomicidal drugs in reversing the inhibition produced by schistosomal infection, lucanthone HCl was found to be inferior to the other drugs used, namely, tartar emetic, stibophen, and niridazole. (Author abstract by permission)

76-0780. Matsubara, H.; Obara, Y.; Kuba, N. (Dep. Agric. Chem., Fac. Agric., Meija Univ., Nagoya, Japan). **[The induction of blindness in baby chicks by *s*-triazine herbicides and related compounds.]** *Nippon Nogei Kagaku Kaishi (J. Agric. Chem. Soc. Jpn.) 49(9): 439-443; 1975. (10 references) (Japanese)*

Nineteen kinds of *s*-triazine herbicides and their related compounds were used in feeding experiments carried out on male baby chicks of Warren- Sex-Sal-Link-F strain. All compounds with substituted hydroxyl and thiol groups on the 2-position of the *s*-triazine ring, except hydroxypropazine and hydroxytrietazine, showed no marked acute oral toxicity in chicks. The other revealed considerable toxicity. When the content of *s*-triazines in feeds was 3-5%, only ammeline caused blindness in baby chicks. It is presumed that the extent of metabolism from *s*-triazine herbicides and related compounds to ammeline through several pathways such as substituted chlorine, dealkylation of *N*-monoalkyl, *N*,*N*-dialkyl, and *O*-methyl groups or hydroxylation of thiol, thiomethyl, and amino groups of compounds were not carried out with levels high enough to induce blindness.

76-0781. Giardina, M. C.; Tomati, U.; Pietrosanti, W. (Lab. Radiobiochim. Ecofisiol. Vegetale del C.N.R., Italy). **Effetti del paraquat su alcuni batteri del suolo responsabili di attivita idrolitiche. [Effects of paraquat on some soil bacteria responsible for hydrolytic activity.]** *Nuovi Ann. Ig. Microbiol.* 24: 191-196; 1973. (11 references) (Italian)

Soil samples were taken from an alluvial terrain, with a high carbonates content, mildly alkaline, and containing lime and clay. They were heated with 100, 200, and 400 ppm of paraquat in a darkened room to avoid photochemical degradation. The total number of bacteria was determined by the Pochon method. Proteolytic, cellulolytic, and ureolytic enzyme activities were determined. Results indicate that paraquat is immediately adsorbed by clay and soil colloids. Extraction did not reveal any trace of paraquat. There was rapid degradation of almost 50% of the initial dosage by 20 days after treatment. The degradation seems to be proportional to the herbicide concentration. The ureolytic microflora was not affected by the treatment. The proteolytic microflora was inhibited by about 50% within 2 days after treatment but was back to normal after 6 days. The cellulolytic microflora showed a slight increase between the first and third days, an inhibition of about 50% around the eighth day, and, from the twelfth to the thirtieth day, a gradual return to normal. In all three cases, no differences were observed at the different application rates used. Only during the first few days do the bacteria show increased oxidative activity, probably due to an accelerated metabolism perhaps linked to a defense mechanism. Up to 1000 ppm paraquat will hardly affect bacteria in the soil; at 10,000 ppm respiration is inhibited, but this is not accompanied by a decline in the number of bacteria in the soil.

76-0782. Annicchiarico Sebastiani, L.; Tarsitani, G.; D'Arca Simonetti, A. (Ist. di Igiene "G. Sanarelli" dell'

Univ. di Roma, Rome, Italy). **Comportamento di un erbicida nel suolo. Nota II. Prometrina, microrganismi e terreno. [Behavior of a herbicide in soil. Part II. Prometryne, microorganisms, and the soil.]** *Nuovi Ann. Ig. Microbiol.* 24(5): 350-358; 1973. (4 references) (Italian)

The resistance of staphylococcus was tested in solutions of prometryne, prometryne with a biodegradable detergent, and prometryne with a nondegradable detergent. Prometryne and detergent concentrations were 18 mg/l. Results indicate that bacterial resistance is lowered most extensively by both combinations of detergent and prometryne. With regard to movement of the staphylococci in the ground, the herbicide alone significantly increases the penetration of the bacteria. Microorganisms were found as far as 120 cm (maximum depth) below the surface. Prometryne is thus hazardous, whether in nondegraded or partially oxidized form, to the water table, not only as a chemical but also as a vehicle for pathogenic organisms. Detergents moderated the effects of prometryne on staphylococcal transport.

76-0783. Jackson, W. B.; Brooks, J. E.; Bowerman, A. M.; Kaukeinen, D. E. (Author address not given). **Anticoagulant resistance in Norway rats. As found in U.S. Cities, Part II.** *Pest Contr.* 43(5): 14-24; 1975. (17 references)

A rat is designated as resistant if it survives a 6 day feeding period and is still alive ten days later. From a 6 day trial only 0.2% of the rodent population would be expected to survive unless resistant. Those that do survive such a test will survive warfarin for 6 days at a higher concentration of 0.025%. Two basic types of resistance have been noticed. One type of rat shows no symptoms and is called "resistant- nonaffected." In the other type, visible bleeding occurs from body openings and/or a drop in bait consumption takes place to 2/3 normal levels. This type is called "resistant-affected." Recognition of the type of resistance may suggest how quickly the problem will spread. The typical resistance problem is characterized by a history of perhaps several decades of anticoagulant rodenticide usage without alternate compounds. Regular use of alternate rodenticides in the problem area should reduce resistant animals to a low level if environmental improvement is concurrent. Resistance has been noted in species other than the Norway rat, including the roof rat (*Rattus rattus*) and the house mouse (*Mus musculus*).

76-0784. Rhee, K. S.; Plapp, F. W., Jr. (Dep. Entomol., Texas A&M Univ., College Station, TX 77843). **Delta-aminolevulinic acid synthetase in the house fly and its possible role in oxidative resistance to insecticides.** *Pestic. Biochem. Physiol.* 5(5): 412-417; 1975. (31 references)

The occurrence of δ-aminolevulinic acid synthetase (ALA synthetase) in housefly mitochondria was investigated in one susceptible, one nonoxidative resistant, and three oxidative resistant strains of housefly. Microsomal oxidase activity was also assayed using (^{14}C)parathion as substrate and determinations were made of cytochrome P-450. ALA synthetase and microsomal oxidase activities were lowest in the susceptible strain and highest in the oxidative resistant strains; similar results were found for the microsomal cytochrome P-450 levels. The strain differences for microsomal oxidase activity were much greater than those for ALA synthetase or cytochrome P-450. The data suggests that the differences in microsomal oxidases and cytochrome P-450 in the oxidative resistant strains of housefly as compared with susceptible strains may be a consequence of ALA synthetase derepression.

76-0785. Marinari, U. M.; Pala, V.; Burlando, F.; Gombos, F.; Marenduzzo, A. (Ist. Pathol. Gen., Univ. Genova, Genoa, Italy). **Danni morfologici indotti da alcuni tossici e polveri industriali sulle ghiandole salivari, sulle ghiandole lacrimali extraorbitali sul fegato e rene di ratto. [Morphologic alterations in the salivary glands, extraorbital lachrymal glands, and liver and kidney of rats by some toxic compounds and industrial dusts.]** *Pathologica* 66(961-2): 437-464; 1974. (70 references) (Italian)

Mercury chloride, lead acetate, zineb, trichloroethylene, and silica dust were administered to Wistar rats. Changes were examined in the submaxillary and parotid salivary glands, extraorbital lachrymal glands, kidney, and liver. Morphological studies with the light microscope indicated the appearance of dystrophic patterns related to the substance used and the time elapsed since the beginning of the poisoning. Lead acetate alterations were essentially found only in the liver and the kidney. Following mercury chloride and trichloroethylene treatment, degenerative phenomena occurred immediately in the glands, kidney, and liver, and progressed to cellular necrosis. In the case of silica treatment, the alterations, although they appeared late, were serious and irreversible. Treatment with zineb produced lesions which were rather slight during the entire period of the poisoning.

76-0786. Schwarz, F. P. (69 Jena, Dr. Otto-Nuschke-Str. 4, DDR). **Synergismus von Tween und Lindan in ihrer Toxizitaet auf Thrombozyten und Leukozyten in Froschblut. [Synergism of the toxic effect of Tween and lindane on thrombocytes and leukocytes in frog blood.]** *Pharmazie* 30(8): 544; 1975. (5 references) (German)

The synergistic effect of Tween 60 and Tween 80 with lindane on frog thrombocytes and leukocytes was studied on blood smears. Compared with the thrombocyte and leukocyte count determined for frogs kept in water with 1% Tween 60 or Tween 80 for 2 days, the thrombocyte and leukocyte levels were significantly decreased, and the percentages of destroyed thrombocytes and leukocytes were significantly increased for frogs kept in water containing 1% Tween 60 or Tween 80 with 0.02% lindane for 2 days. The highly significant difference indicates the synergism of Tweens with lindane.

76-0787. Rouchaud, J.P.; Decallonne, J. R.; Meyer, J. A. (Univ. Catholique Louvain, Lab. Phytopathol., Heverlee, Belgium). **Metabolic fate of methyl-2-benzimidazole carbamate in melon plants.** *Phytopathology* 64(12): 1513-1517; 1974. (12 references)

The metabolism of methyl-2-benzimidazole carbamate (MBC, carbendazim) was studied in melon plants (*Cucumis melo*, L.) grown for 5 days in nutrient solution containing 50 μg/ml benomyl with 5.58 μg ^{3}H-MBC or for 2 mo in nutrient solution containing 20 μg/ml of nonradioactive benomyl. In the plants treated with ^{3}H-MBC and benomyl, most of the radioactivity was recovered in the leaves produced before and during treatment. In the plants treated with nonradioactive benomyl, seven metabolites were identified in the leaves: five were recovered in the benzene extract, and two conjugated compounds were recovered in the aqueous extract. The metabolites were identified by gas-liquid chromatography as MBC, 2-aminobenzimidazole (2-AB), benzimidazole, *o*-aminobenzonitrile, aniline, and the β-glycosidic conjugates of MBC and 2-AB. Some other conjugated products and trifluoroacetylated metabolites were not identified.

76-0788. Elbaum, D.; Nagel, R. L.; Bookchin, R. M.; Herskovits, T. T. (Dep. Med., Div. Hematol., Albert Einstein Coll. Med., New York, NY 10461). **Effect of alkylureas on the polymerization of hemoglobin S.** *Proc. Natl. Acad. Sci. USA* 71(12): 4718-4722; 1974. (36 references)

Hemolysates were prepared from the heparinized venous blood of patients with sickle cell anemia (homozygous for Hb S) and normal individuals. The effects of equivalent concentrations of various alkylureas (0.1 *M* and 0.2 *M*) were determined on the gelation of deoxy-HBS and on red cell sickling. Methyl-, ethyl-, propyl-, and butyl-alkylureas inhibited both the gelation of Hb S and red cell sickling without denaturation of the hemoglobin or intrinsic alteration of its oxygen affinity. This effect was directly proportional to the length of the alkyl chain and it substantiated the importance of hydrophobic interactions in the polymerization of hemoglobin S. Further systematic investigations with these compounds may help quantitate the role of hydrophobic interactions in this system so as to further explain the polymerization of Hb S.

76-0789. Mueller, H.; Schuphan, W. (Bundesanstalt Qual.-Forsch. Pflanzlicher Erzeugnisse, 6222 Geisenheim, Germany). **Zur Anwendung von 2,4-Dichlorphenoxyessigsaeure (2,4-D) bei Tomaten. Der Metabolismus des 2,4-D in Tomatenfruechten. [The application of 2,4-dichlorophenoxyacetic acid (2,4-D) to tomatoes. Metabolism of 2,4-D in fruits of tomatoes.]** *Qual. Plant. Pl. Foods Hum. Nutr.* 24(3/4): 405-413; 1975. (15 references) (German)

The metabolism of 2,4-D, used for the treatment of tomato inflorescences, was studied in fruits of tomato, using ^{14}C-labeled compound. After application of 0.483 and 1.025 μg of 2,4-D, the 2,4-D residues in the fruits were 0.34 ppb and 0.55 ppb, and non-metabolized 2,4-D accounted for 31.5-31.7% of the total radioactivity. The metabolites found were 4-hydroxy-2,3-dichlorophenoxyacetic acid, and a smaller quantity of 4-hydroxy-2,5- dichlorophenoxyacetic acid. Acid hydrolysis of *n*-butanol extract also yielded 2,4-D and an unidentified metabolite.

76-0790. Vettorazzi, G. (Food Additives, World Health Org., Geneva, Switzerland). **State of the art of the toxicological evaluation carried out by the Joint FAO/WHO Expert Committee on Pesticide Residues. I. Organohalogenated pesticides used in public health and agriculture.** *Residue Rev.* 56: 107-134; 1975. (30 references)

The general introduction to this review describes briefly the "modus operandi" of the Joint FAO/WHO Meeting on Pesticide Residues in the toxicological evaluation of pesticide chemicals and their residues in food. The assessment of toxicity (concept of acceptable daily intake (ADI), information required for the toxicological evaluation, recommendation of residue limits, and estimation of daily intakes, etc.), as carried out by the Joint Meeting, is reviewed in the light of relevant documents. In the second part, short toxicological summaries reiterate in broad terms the current thinking on the toxicity of the organohalogenated pesticide chemicals which have been considered by the Joint Meeting from the outset of its activities in 1963 up to 1973. References are also made to the major conclusions of other expert bodies in the World Health Organization and the International Agency for Research in Cancer on the compounds reviewed. This review may be considered the first in a series of general reviews which will comprise the major categories of pesticide chemicals examined by the Joint Meeting; the next review will be on organophosphorus pesticides.

76-0791. Paulson, G. D. (Metab. Radiat. Res. Lab., Agric. Res. Serv., Fargo, ND 58102). **Metabolic fates of herbicides in animals.** *Residue Rev.* 58: 1-111; 1975. (145 references)

The literature dealing with the animal metabolism of the following classes of herbicides was reviewed: dinitroaniline, substituted uracil, benzoic acid and related compounds, nitrile and related compounds, halogenated aliphatic, carbamate, thiocarbamate, amide, bipyridilium, triazole, diphenyl ether, phenol, triazine, urea, and phenoxy herbicides. The information which was emphasized in this review includes (1) the rates and routes of elimination of the herbicides and their metabolites, (2) the isolation and identification of herbicide metabolites in milk, tissues, eggs, urine, and feces, and (3) quantitation of

the parent compounds and their metabolites in the various fractions. A special effort was made to critically evaluate and summarize the supportive evidence for the structure of herbicide metabolites that have been reported. Most of the herbicides which have been reported were readily absorbed from the gut after oral treatment. A large percentage of most of the herbicides that have been investigated were eliminated in the urine and feces (as the parent compound but more commonly as metabolites) within a few days after treatment. The types of animal herbicide metabolism which have been reported include the following: oxidation, reduction, dealkylation, dehalogenation, hydroxylation, hydrolysis, acetylation, methoxylation, sulfate ester conjugation, glucuronic acid conjugation, and amino acid conjugation.

76-0792. Rowlands, D. G. (Insecticide and Storage Dep., Pest Information Contr. Lab., Slough, England). **The metabolism of contact insecticides in stored grains. III. 1970—1974.** *Residue Rev.* 58: 113-160; 1975. (200 references)

Many general aspects of the subject were covered by the two previous reviews. Important recent changes in handling harvested cereal grains include more bulk transportation—particularly containerization, processing closer to the site of production, resistance to pesticides in many granivorous insects and the alarmingly unpredictable cross-resistance spectra in some species, and a hardening in the attitude of governments and the food industry to the use of pesticides. Pesticide manufacturers are currently restricting their involvement in the stored grain area. The market is small and unpredictable due to cross-resistance. However, a number of interesting and potentially useful compounds have appeared, notably (bio)resmethrin, pirimiphos-methyl, and chlorpyrifos-methyl, which reflect attempts to provide somewhat more persistent compounds under adverse storage conditions than is malathion—currently the most widely-used control agent. Inevitably, there is interest also in alternative methods of control, from the obvious physical methods (drying, cooling, air-tight storage) to use of pheromones, insect hormone analogues, and larvicides, all of which may have some future potential. Additionally, the acaricidal properties of conventional pesticides used on stored grain have become more desirable due to increased problems of mite infestation in temperate climates and the tendency to store higher-moisture grain protected from microbial spoilage by propionic acid. There is a need to evaluate the effectiveness of conventional pesticides at lower temperatures than the standard laboratory "screening" trials, e.g., 10°C or less. Whereas uneven distribution of pesticide among bulk grains is likely to equilibrate in the long-term, there is still a continuing need for information on the location of intermediate and terminal pesticide residues within each grain and within the bulk. This becomes even more necessary when use of the insect hormone analogues is contemplated, for the location of such compounds obviously governs their availability at critical times during the insect's developmental cycle. Most manufacturing companies with compounds intended for stored grain use now undertake metabolic and terminal residue studies but there are still a large number of important gaps in our information on the subject.

76-0793. Kenaga, E. E. (Dow Chemical U.S.A., Midland, MI 48640). **The evaluation of the safety of 2,4,5-T to birds in areas treated for vegetation control.** *Residue Rev.* 59: 1-19; 1975. (36 references)

2,4,5-T (2,4,5-trichlorophenoxyacetic acid) and its salts and ester derivatives and formulations are recommended for use in the control of woody and herbaceous weed plants at dosages ranging from 0.5 to 16 lb of 2,4,5-T acid equivalent/A. Residues on treated plants, based on a 1 lb of 2,4,5-T/A application, range downwards from 144 ppm, depending on climate, time after application, spray coverage, vegetative density, vegetative surface-area-to-volume ratio, and other factors. 2,4,5-T and derivatives are metabolized or degraded by microorganisms, birds, plants, sunlight, etc., often rapidly. Dietary levels of 2,4,5-T and derivatives causing no effect, or LC50s in laboratory tests, are high enough so that they normally exceed the residues expected in dietary food of birds in areas treated with recommended dosages of 2,4,5-T, and ester and salt derivatives should not be affected acutely or chronically in the egg, chick, or adult stages of life.

76-0794. Ware, G. W. (Dep. Entomol., Univ. Arizona, Tucson, AZ). **Effects of DDT on reproduction in higher animals.** *Residue Rev.* 59: 119-140; 1975. (102 references)

There are abundant reproductive studies with birds and mammals examining the wide range of effects of DDT and related materials. But because of the spectrum of species, dosage, compound, age, duration, route of exposure, sex, and metabolism-storage rate involved, interpretation and synthesis of effects are difficult. Several broad generalizations can be made which are well supported by various research techniques. DDT is estrogenic and uterotropic in birds and mammals, more so in the latter, the *o,p'*-isomer being the primary agent, and only approaching 10^{-4} the effect of estradiol. The *o,p'*-isomer is metabolized and excreted much more readily than the *p,p'*-isomer by both birds and mammals. The effects of DDT on reproduction are much greater in birds than mammals, and greater in females than in males. Two effects resulting in reproductive failure can be observed in both mammals and birds: (1) post-birth or -hatch death resulting from direct passage of toxic levels of DDT to the young through milk or the egg (2) and fetal implant absorption in mammals and eggshell thinning resulting in breakage and death of the embryo. The latter is the direct physiological effect of DDT on the parent, which may be explained differently for different species. DDT, TDE, and DDE are effective in inducing liver microsomal

enzymes in mammals and birds following their chronic and sometimes acute ingestion. Finally, the eggshell-thinning syndrome is probably the end product of subtle changes in steroid hormone-calcium metabolism caused by hepatic microsomal enzyme induction resulting from chronic ingestion of DDT. (Author abstract by permission)

76-0795. Vlassak, K.; Livens, J. (Lab. Soil Fertility Soil Biol. Katholieke Univ., Louvain, Belgium). **Effect of some pesticides on nitrogen transformations in soil.** *Sci. Total Environ.* 3(4): 363-372; 1975. (14 references)

Samples of two loess soils were incubated with diallate, cycloate, lenacil, phenmedipham, PCA, heptachlor, aldrin, aldicarb, oxamyl, and profos for 7-28 days. The pesticides were added at 0.5-1.5 times the recommended field application rate to sufficient water to reach the 65% water holding capacity of the soil. Nitrification in soil B, which had a lower organic content and lower biological activity than soil A, was retarded by field application rates of PCA, phenmedipham, oxamyl, diallate, cycloate, aldicarb, and profos, while nitrification in soil A was retarded only by the first three. In most cases, the inhibitory effects on nitrification were no longer evident after 14-28 days of incubation. The process of nitrification was more sensitive to pesticide inhibition in the presence of urea-N fertilizer than in its absence. Oxamyl retarded the rate of soil denitrification in soil B during the first week only. Oxamyl had a greater effect on the nitrogenase activity of soil B than did phenmedipham.

76-0796. Tewfik, M. S.; Hamdi, Y. A. (Sect. Weed Control, Agric. Res. Cent., Ministry Agric., Orman, Giza, Egypt). **Metabolism of fluorodifen by soil microorganisms.** *Soil Biol. Biochem.* 7(2): 79-82; 1975. (10 references)

The metabolism of fluorodifen by soil microorganisms in the presence and absence of other sources of carbon and nitrogen was studied. The degradation of this herbicide continued for 5 days when benzoate or acetate and ammonium sulfate were added to the cultures, and it continued for more than 5 weeks when fluorodifen was the sole source of carbon and nitrogen. Nitrite ions were produced at concentrations of 5-80% of the fluorodifen nitro-nitrogen present under all conditions. The highest nitrite concentration was obtained when additional carbon sources were used with fluorodifen, and the lowest nitrite concentrations were obtained when fluorodifen was used as the sole source of carbon and nitrogen. The nitrite concentration reached a maximum value after a few days of incubation, after which it declined rapidly. *p*-Nitrophenol and quinol were identified in the acid-ether extracts of the cultures. It is suggested that the first step in degradation of fluorodifen by soil microorganisms is the hydrolysis of the ether linkage followed by the direct elimination of the nitro groups as nitrite ions.

76-0797. Mingelgrin, U.; Yaron, B. (Inst. Soils and Water, Agric. Res. Organ., Volcani Cent., Bet Dagan, Israel). **The effect of calcium salts on the degradation of parathion in sand and soil.** *Soil Sci. Soc. Am. Proc.* 38(6): 914-917; 1974. (13 references)

The effect of $CaCO_3$ and $CaSO_4$ on *0,0*-diethyl *0*-(*p*-nitrophenyl) phosphorothioate (parathion) degradation was investigated. The decomposition in dry acid-washed sand as a relatively inert matrix, as well as in two dry soils, was measured. As shown previously in the case of other Ca-containing surfaces, both $CaCO_3$ and $CaSO_4$ enhanced parathion degradation in the inert medium. In every soil-salt mixture the parathion decomposition curves were different. In one soil $CaCO_3$ even slowed down the decomposition. In another soil, $CaSO_4$ enhanced decomposition up to 5% salt concentration, but additional $CaSO_4$ did not produce further enhancement. (Author abstract by permission)

76-0798. Wolf, D. C.; Martin, J. P. (Dep. Soil Sci. Agric. Eng., Univ. California, Riverside, CA). **Microbial degradation of 2-carbon-14 bromacil and terbacil.** *Soil Sci. Soc. Am. Proc.* 38(6): 921-925; 1974. (19 references)

Studies were conducted to determine the degradation rate of 2.88 ppm 2-^{14}C bromacil, 3-*sec*-butyl-5-bromo- 6-methyluracil, and terbacil, 3-*tert*-butyl-5-chloro-6- methyluracil, in a neutral sandy loam soil. After a 600-day incubation period at 60% water holding capacity (approximately 1/3 bar), 22.1% of the added ^{14}C from bromacil was recovered as $^{14}CO_2$. The addition of 0.5% corn stalks (*Zea mays* L.) or lima bean straw (*Phaseolus limensis*) increased the value to 32.5% and 33.6%, respectively. Under the same conditions, 27.5% of the activity added as 2-^{14}C terbacil was recovered as $^{14}CO_2$ and the addition of 0.5% corn stalks or lima bean straw increased this value to 37.0% and 38.2%, respectively. No $^{14}CO_2$ was evolved from sterile soil. Under saturated conditions less than 0.5% of the added activity for both bromacil and terbacil was evolved as $^{14}CO_2$ in 145 days but essentially all of the activity in the bromacil treated soil was present as a metabolite. In a second test about 53% of added bromacil was still present as the parent compound after 115 days. The presence of bromacil or terbacil in the soil did not affect the activity of the soil microbial population as measured by total CO_2 production. (Author abstract by permission)

76-0799. Lammler, G.; Gruner, D. (Inst. Parasitol., Justus Liebig Univ., Giessen, Germany). **Chemotherapeutic studies on *Litomosoides carinii* infection of *Mastomys natalensis*. 6. The filaricidal activity of organophosphorus compounds.** *Tropenmed. Parasitol.* 26(3): 359-369; 1975. (63 references)

A comparative investigation was made of the filaricidal activity of various organophosphorus compounds in *Litomosoides carinii* infection of *Mastomys natalensis* and an evaluation of their possible usefulness

for further experimental and clinical investigations in filarial infections. The results of this study confirm the filaricidal potency of this chemical class. The anthelmintic haloxon proved the most effective with high activity against microfilariae and a favorable chemotherapeutic range. The low acute oral toxicity of haloxon in many species of lab and domestic animals and the fact that only a slight to moderate depression in red cell cholinesterase activity occurs for about 7 days in sheep even after massive doses may be advantageous factors. The organophosphates fenthion, Dursban, metrifonate, coumaphos, crufomate, and naphthalophos also showed pronounced microfilaricidal activity but had different and lower chemotherapeutic indices. On the basis of experience with fenthion as a systemic insecticide in animals, it is suggested that the topical administration of organophosphorus filaricides be considered in the treatment of human and animal onchocerciasis and other filarial infections of the subcutaneous tissues. The preparations chlorfenvinphos, benoxafos, cythioate and imidan were without marked microfilaricidal action at tolerable dose schedules. The chemotherapeutic indices for the following compounds were determined to be: haloxon, more than 80; fenthion, s.c., 16; fenthion, p.o., 12; chlorpyrifos, 8; metrifonate, 6; coumaphos, 5; crufomate, 2.5; and naphthalophos, 2.4. The organophosphorus compounds tested showed no influence on the mobility or viability of the adult worms of *Litomosoides carinii*.

76-0800. Rossi, L.; Repetti, G.; Ravera, M.; Santi, L. (Ist. Oncol., Univ. Genova, Genoa, Italy). **Attivita cancerogena da DDT in ratti Wistar.** [**Carcinogenic action of DDT in Wistar rats.**] *Tumori* 61(1): 113; 1975. (Italian)

At the age of 7 weeks, 72 Wistar rats were fed a diet containing DDT dosages of 500 ppm. The same number of rats served as a control group. Results indicate DDT is hepatocarcinogenic. Out of 48 autopsied animals, 24 displayed hepatomas; no such tumors were detected in the control group. The female rats were 30% more susceptible to DDT induced cancer. The latency period was 73 weeks for females and 85 for males. Tumors varied in size from a few mm to 10-12 mm. In at least 50% of the cases, the cells were in mitosis. The incidence and latency of other tumors did not differ significantly from those of the control group.

76-0801. Sagner, G.; Becker, K. (Inst. Wasser-, Boden-Lufthyg. Bundesgesundheitsamt., Berlin, Germany). **Hautresorption von Warfarin bei Mensch und Ratte.** [**Skin resorption of warfarin by man and rats.**] *Umwelthygiene* 1(6): 156-158; 1975. (3 references) (German)

The effect of warfarin on blood clotting time was studied in female Wistar rats after percutaneous, subcutaneous, and oral administration. Blood from the tail vein was used for clotting measurement. While the application of three 10 mg/kg doses on the tail on three consecutive days caused no change in the clotting time, the application of 3 × 50 mg/kg and 3 × 100 mg/kg increased the clotting time to 146.9% and 219.8% of the control, respectively. An oral dose of 0.6 mg/kg on three consecutive days increased the clotting time to 149.5%, while a 0.3 mg/kg dose was ineffective. Single, s.c. doses of 2 and 4 mg/kg increased the clotting time to 113% and 232.3% of the control values, respectively. The findings indicate the possibility of disturbances in the blood clotting due to skin resorption of warfarin and other coumarin derivatives during the preparation of bait for rats, as was demonstrated by the case of a Swedish farmer who developed uremia, nose-bleeding, and hematomas following prolonged contact with warfarin. The blood clotting time was 11 min. Complete recovery was achieved by the administration of vitamin K.

76-0802. Gralla, E. J. (Mason Res. Inst., Worcester, MA). **Drug interaction.** *Vet. Clin. N. Am.* 5(4): 717-726; 1975. (8 references)

Fundamental concepts of drug interaction are the primary objectives of this review article. Virtually every drug interaction is ultimately the result of a suppressed or, more commonly, an enhanced pharmacological activity inherent in one or both of the drugs involved. Phenylbutazone given in combination with warfarin or coumarin has caused profound hemorrhaging when both drugs are given at levels normally safe for either drug by itself. In this case the phenylbutazone displaced the more weakly bound anticoagulant, enhancing its effect. Chemical interactions are not always drug-related and can involve environmental chemicals. Chlorinated hydrocarbon insecticides, including DDT and chlordane, stimulate microsomal enzyme systems and increase drug metabolism. Animals exposed to DDT showed a sudden increase in sleeping time following the administration of hexobarbital. This change was traced to DDT-stimulated hepatic enzymes. A similar situation was shown in humans by studying levels of 6,β-hydroxycortisone in industrial workers engaged in DDT manufacture. As 6,β-hydroxycortisone is a natural metabolite of cortisone, it serves as a sensitive indicator of the spontaneous rate of endogenous cortisol metabolism and microsomal enzyme activity. Workers who had been exposed carried elevated serum levels of this insecticide, correlating significantly with higher levels of urinary 6,β-hydroxycortisone. Serum half-life of phenylbutazone administered to these workers was considerably shorter, supporting the conclusion that exposure to DDT stimulated hepatic drug metabolism in man as well as in animals.

76-0803. Derevici, A.; Nitu, V. (A.C.A. Med. Comm. B.P., Bucharest, Rumania). **Determinazione dell'acetilcolinesterasi nelle api normali e intossicate.** [**Determination of acetylcholinesterase in normal and poisoned bees.**] *Veterinaria (Milan)* 21(5-6): 255-266; 1972. (57 references) (Italian)

A total of 3501 bees were captured from a location where pesticides had not been applied. One group was

captured in December and one group was captured in May; the former were in semi-hibernation and the latter in full activity. Experimental procedures were identical for both groups. Some of the bees were fed one of ten dosages of DDT; others were intoxicated topically with DDT diluted in acetone at 200 mg to 20 ml, then diluted to 200 ml. Of these, 1175 bees were kept as controls. Enzyme activity was determined by the Hestrin method. Symptoms appeared in five stages: latency, excitation, uncoordinated movement, an adynamic phase, and death. All the December bees intoxicated by either route died, 12% of the DDT-fed May bees died, and 25% of the topically exposed May group died. In the case of the December group, the control group bees had 3.1 units of cholinesterase per bee and the two other groups 4.0 units per bee. May control bees had 4.22 units per bee, the topically exposed group had 13 units per bee, and the DDT-fed group had 2.3 units per bee. Topically intoxicated bees also demonstrated pronounced dehydration. It is necessary to include physiological considerations in the interpretation of the data.

76-0804. Kull', A. K. (All-Union Sci. Res. Inst. Exp. Vet. Med.). **Vliyanie ftalofosa na kurinye embriony.** [**Effects of phthalophos in chicken embryos.**] *Veterinariya (Moscow)* 9: 104-106; 1975. (Russian)

The embryotoxic and teratogenic action of phthalophos was studied in chicken embryos. Phthalophos in physiological solution was introduced into the amniotic cavity of 10 day-old embryos in doses of 6, 63, and 635 mg, or into the yolk sac of 7-8 day-old embryos in doses of 3, 317.5, or 635 mg. The overall mortality, indicating the embryotoxic effect of phthalophos, was 22.6-52.8%, and the incidence of teratogenic changes was 1.4-6.8%. The mortality rate was 15.6-45.7% after the introduction of physiological saline solution alone, and 15.6-45.7% spontaneous mortality was observed in the control group. The incidence of spontaneous teratogenic changes was 1.1-1.2% in the control group. The teratogenic effect of phthalophos was most pronounced on the mesodermal formations (extremities and abdominal wall), and weakest on the ectodermal formations, such as the brain, eyes, and bill.

76-0805. Glukhova, L. G. (Dep. Pharmacol., Ternopol Med. Inst., USSR). **Nekotorye biokhimicheskie i morfologicheskie izmeneniya v pecheni potomstva belykh krys pri vozdeystvii polikhlorpinena.** [**Some biochemical and morphological changes in liver of white rat caused by polychloropinene.**] *Vrach. Delo* 10: 135-136; 1974. (7 references) (Russian)

Biochemical and morphological changes were studied in the liver of the offspring of white rats fed daily 1/100 of LD50 doses of polychloropinene orally for 2.5 months during pregnancy and lactation. Some of the offspring were subsequently fed 1/10 of LD50 for 2/5 months. Reduction of cholate formation and cholate secretion by 2.5 fold was observed in the offspring. This change was more pronounced in animals that had been fed additional polychloropinene. The reduction in the total bile acid content was due mainly to the reduction of taurocholic, glycocholic, and deoxycholic acids. Moderate plethora of the liver, dilatation of the hepatic vessels, fatty degeneration of many hepatocytes, lymphoid-histiocytic infiltration of certain interlobular veins, fragmentation of argentophilic fibers of the intralobular capillaries, and moderate reduction of the glycogen level were observed. The biochemical changes correlated with the morphological ones. The findings indicate the transfer of polychloropinene with milk.

76-0806. Yazar, O.; Shively, J. M.; Camper, N. D. (Dep. Biochem., Clemson Univ., Clemson, SC 29631). **Effects of selected herbicides on bacterial populations in nontreated and treated water.** *Water Resour. Bull.* 11(2): 294-299; 1975. (4 references)

Bacterial populations obtained from nontreated and herbicide-treated fresh-water lakes and ponds in South Carolina were incubated for 72 hr with 100 or 200 mg/l diuron, dichlobenil, or diquat. The bacterial populations in the fresh, untreated lake water decreased after the addition of herbicide, but the final population numbers were significantly greater than in untreated control samples. Similar observations were recorded for the bacteria in the dichlobenil- and diuron-treated waters. The initial decrease in bacterial numbers could be attributed to a bactericidal effect on selected species within the population, while the rapid growth rate and subsequently larger populations may have reflected a selective enrichment for organisms which are herbicide resistant or for those organisms which are able to adapt and utilize the chemical as a nutrient source.

76-0807. Bogenschuetz, H. (Forstl. Versuchs- und Forschungsanst. Baden-Wuerttemberg, Abt. Waldschuetz, Stegen-Wittental b. Freiburg, Germany). **Pruefung des Einflusses von Pflanzenschutzmitteln auf Nutzinsekten. Erarbeitung eines Laborverfahrens mit der Ichneumonide *Coccygonimus turionellae* (L.).** [**Studies on a laboratory method using *C. turionellae* (L.) (Hym., Ichneum.) for examining the influence of pesticides on beneficial insects.**] *Z. Angew. Entomol.* 77(4): 438-444; 1975. (13 references) (German)

The mechanism and particularities of the parasitization of *Galleria mellonella* L. pupae by *Coccygonimus turionellae* (L.) were studied in connection with the elaboration of a laboratory method for the study of the effects of pesticides on useful insects. Superparasitism of pupae of *G. mellonella* (L). was found to be prevented to a certain extent if at least one day elapsed between the first parasitization (oviposition) and the second puncture of the host pupa by another female, which indicates that females of *C. turionellae* (L.) are able to distinguish between parasitized and non-parasitized pupae. The fertility of mated and unmated females was the same.

76-0808. Markosyan, V. E. (Dep. Ind. Hyg., Erevan State Med. Inst., USSR). **K voprosu toksikologicheskoy kharakteristiki mednoammiachnogo tsianurata. [Toxicological characteristics of cupric ammonium cyanurate.]** *Zh. Eksper. Klin. Med. 15(4): 52-57; 1975. (5 references) (Russian)*

The acute and chronic toxicity of cupric ammonium cyanurate was studied in albino rats. The acute oral LD16, LD50, and LD84 were determined to be 535 mg-kg, 1,400 ± 286 mg/kg, and 2,250 mg/kg, respectively. The LC16, LC50, and LC84 are 33.8 mg/m^3, 88 ± 31 mg/m^3, and 144 mg/m^3. No skin irritation and skin resorption were observed in acute and subacute contact tests. These findings indicate that cupric ammonium cyanurate is of medium toxicity with pronounced cumulative property (coefficient of cumulation 1.66 ± 0.17 for 10% LD50 and 1.32 ± 0.07 for 5% LD50). Subacute and chronic poisoning tests with 10%, 5%, 2%, and 1% LD50 revealed qualitative and quantitative changes in the peripheral blood, such as anisocytosis, poikilocytosis, polychromasia, granular inclusions in some leukocytes, and reduced erythrocyte, leukocyte, and hemoglobin levels, as well as morphological changes in the lungs, heart, kidneys, spleen, and liver. Leukocytes, erythrocytes, and hemoglobin were most sensitive to cupric ammonium cyanurate. The threshold concentration for leukocytes, erythrocytes, and hemoglobin was found to be 25 mg/kg.

See also **76-0604** **76-0605** **76-0606** **76-0674**

76-0809. Cannard, A. J.; Criddle, W. J. (Dep. Chem., Univ. Wales Inst. Sci. Technol., Cardiff, Wales). **A rapid method for the simultaneous determination of paraquat and diquat in pond and river waters by pyrolysis and gas chromatography.** *Analyst (London)* 100(1197): 848-853; 1975. (6 references)

A rapid method is described for the determination, in aqueous systems, of two widely used herbicides known commercially as paraquat aand diquat. Pyrolysis of these herbicides under carefully controlled conditions, followed by gas-chromatographic analysis of the pyrolysate, allows detection of the herbicides down to 0.01 ppm. At the lowest concentration levels (0.01-0.1 ppm), there is some loss of linearity of response, possibly as a result of adsorption of the herbicides on the glass surfaces of the vessels used. This effect may have resulted in substantial errors in previously reported low levels of paraquat and diquat and may also occur in the determination of other ionic herbicides. (Author abstract by permission)

76-0810. Lunde, G.; Gether, J.; Josefsson, B. (Cent. Inst., Ind. Res., Blindern, Oslo, Norway). **The sum of chlorinated and brominated non-polar hydrocarbons in water.** *Bull. Environ. Contam. Toxicol.* 13(6): 656-660; 1975. (15 references)

The use of chlorine as a common parameter in the study of the nonpolar chlorinated hydrocarbons in the aquatic environment is proposed. In addition, the ratio of the sum of chlorine to bromine may be a useful indicator of pollution by such compounds. The detection of chlorine and bromine in this form is based on neutron activation analysis. The nonpolar organic micropollutants are isolated from the water sample by continuous extraction with a nonpolar solvent, and the inorganic halides are subsequently removed from the basic extract by washing with halide-free water. The extract is concentrated in a Kuderna-Danish apparatus, treated with H_2SO_4, and neutron-activated in halide-free polyethylene vials together with chlorine and bromine standards. ^{38}Cl and ^{80}Br are used for the determination of chlorine and bromine, respectively. In samples of fresh and sea water analyzed thus far, the total content of nonpolar organic bound chlorine has exceeded by a factor of 10 to 100 that which can be accounted for by PCBs.

76-0811. Suzuki, K.; Tauchi, K. (Inst. Anim. Reprod., Ibaraki-Ken, Japan). **Modification of Michael's method [sic] for determination of serum acetyl choline esterase activity.** *Bull. Environ. Contam. Toxicol.* 14(6): 674-680; 1975. (10 references)

A modification of Michel's method for the determination of serum acetylcholinesterase activity is proposed. The serum sample is incubated for 10 min at 37°C with aqueous buffer solution and the initial pH (pH*i*) is measured with a pH meter. Substrate containing 0.165 *M* acetylcholine chloride in distilled water is then added and the final pH (pH*f*) is measured after another hr of incubation. The cholinesterase activity is calculated using the equation: DeltapH/hr + (pH*i* − pH*f* − *b*) × *i*, where *b* is a correction factor for nonenzymatic hydrolysis corresponding to pH*i* and pH*f*, and *i* is a correction factor for varitions in DeltapH/hr with pH corresponding to pH*i*. The relation between pH and time of incubation is almost linear up to 180 min. Titration of the incubation medium with acetic acid allows transformation to units of μM/ml/hr or min, thus allowing comparison between the values obtained with the DeltapH methods and those obtained using other methods. The DeltapH method yields stable and precise values for acetylcholinesterase activity.

76-0812. Khan, S. U. (Chem. Biol. Res. Inst., Canada Agric., Ottawa, Ontario, Canada). **Determination of paraquat residues in food crops by gas chromatography.** *Bull. Environ. Contam. Toxicol.* 14(6): 745-749; 1975. (7 references)

A method is described for the gas chromatographic determination of paraquat residues in lettuce, carrots, and onions. The procedure involves extraction of the sample with 5*N* H_2SO_4 and catalytic hydrogenation of the acid extract. This is followed by column cleanup on alumina and analysis on a gas chromatograph fitted with an alkali flame ionization detector with a CsBr annulus. The 1.5 × 0.6 cm glass column is packed with 3% Carbowax 20 *M* plus 1% KOH coated on 80-100 mesh Chromosorb WHP. The column, detector, and injector temperatures are 150, 200, and 150°C, respectively, the nitrogen carrier gas flow rate is 55 ml/min, and the hydrogen and air flow rates are 40 and 400 ml/min, respectively. The retention time of paraquat is 1.8 min. Recoveries of paraquat added to lettuce, carrots, and onions at 0.5, 0.1, and 0.05 ppm were between 75 and 86%, with a maximum standard error of 4%. The lower limit of detection is in the 0.05 ppm range, and the cleanup procedure is effective in removing interfering substances.

76-0813. Steinwandter, H. (Hessische Landwirtschaftl. Versuchsanst., D-61 Darmstadt, Germany). **Eine neue stationaere Phase fuer die Pestizidanalytik. [A new stationary phase for pesticides analysis.]** *Chemosphere* 4(6): 371-373; 1975. (7 references) (German)

A new stationary phase, composed of 3 parts 6% OV-210 and 1 part 3% Dexsil, was developed for the gas-chromatographic separation and determination of organochlorine pesticides. Being a polar phase, OV-210 alone is suitable for the separation of hexachlorobenzene and BHC isomers, while Dexsil, a nonpolar phase, is suitable for the distinct separation of endrin and DDT metabolites. The new stationary phase has the advantage over 1.5% OV-17 + 2% OV-210, a mixed phase claimed to be best presently, in that it permits a better separation of hexachlorobenzene from α-BHC and of *p,p'*-DDE from dieldrin.

76-0814. Haering, M.; Weiss, H. (Eidgenoess. Materialpruef. Versuchsanst., Sektion Chemie, 9001 St. Gallen, Switzerland). **Bemerkungen zur Rueckstandsanalytik von Carbaryl (*N*-Methyl-1-naphthyl-carbamat). [Comments on the residue analysis of carbaryl (*N*-methyl-1-naphthylcarbamate).]** *Chimia* 29(9): 384-385; 1975. (2 references) (German)

The solubility of carbaryl was studied in different solvents and solvent pairs, and an improved cleanup method is proposed for foodstuffs extracts. The solubility (in g/100 ml) was determined to be 16.6 g in methylene chloride, 16.1 g in acetone, 9.3 g in acetonitrile, 7.6 g in ethyl acetate, 5.2 g in ethanol, 0.05 g in hexane, 0.03 g in heptane, 0.06 g in cyclohexane, and 0.03 g in an 80/20 ratio of acetonitrile and water. No association was found to take place in solvent pairs. Single extraction with an equal volume of acetonitrile was found to give a yield rate of 98.3% from hexane, 98.9% from heptane, 85.6% from carbon disulfide, 98.6% from α-pinene, and 98.2% from cyclohexane. With an equal volume of hexane, the extraction rate was 51.5% from a 20/80 ratio of acetonitrile and water, and 3.2% from a 60/40 ratio of acetonitrile and water. The findings indicate that cleanup of a hexane extract by shaking with acetonitrile and subsequent extraction with hexane is unsuitable for the extraction of carbaryl. Instead, the dry residue should be taken up in acetonitrile, diluted with water to 60% acetonitrile, and waxy impurities should be extracted with small portions of hexane. In this manner, it is possible to limit the carbaryl losses to below 3%.

76-0815. Evans, J. E.; Arnold, J. T. (Finnigan Corp., Sunnyvale, CA 94086). **Monitoring organic vapors.** *Environ. Sci. Technol.* 9(13): 1134-1138; 1975.

Mass spectrometry and gas chromatography are becoming two of the most popular and useful techniques available to the environmental chemist and industrial hygienist. High sensitivity and definitive identification account for this popularity. Because of the inherent flexibility of the mass spectrometer, the system is ideally suited for a number of projects. Among the past and present uses for the system are the identification of pesticides and the monitoring of cholinesterase inhibiting chemicals. One of the most useful applications is that of point source monitoring. Due to the instrument's sensitivity and fast response, it is able to measure local differences in concentration within a small area. This ability becomes extremely important in those cases where exposure levels differ drastically within a single work area. One of the most important future applications may be field detection and identification of organic contaminants in drinking water and wastewaters.

76-0816. Maultz, S. (Cent. Environ. Anal. Cont., Cracow, Poland). **Polarograficzna modyfikacja ja oznzczania DDT, metoksychloru i gamma-HCH w wodzie metoda chromatografii cienkowarstwowej. [Polarographic modification of DDT, methoxychlor, and gamma-HCH determination method in water by thin-layer chromatography.]** *Gaz Woda Tech. Sanit.* 49(3): 83-85; 1975. (20 references) (Polish)

A modified method is submitted for the determination of polychlorinated pesticides in surface waters. It is based on thin-layer chromatographic initial separation of the compounds studied on sheets of silica gel, releasing them from the adsorbent layer by scraping them off, dissolving in an ethanol solution of tetramethylammonium chloride, and subsequent polarographic determination. The method was tested on amounts of insecticides added to surface water at concentrations usually encountered there. The modification consisted of detecting the insecticides, chromatographed on the silica gel, with an ethanol solution of rhodamine B (instead of butter yellow). The other steps were identical to those normally used in thin-layer chromatography. Sample solutions of DDT, methoxychlor, and gamma-HCH (lindane) in acetone were prepared and mixed with the experimental water at calculated quantities. The results obtained were evaluated statistically. It was established that the mean recovery level of DDT and methoxychlor by polarography (92-100%) was better than with thin-layer chromatography (87-100%); for gamma-BHC the values were 82-100% and 68-100%, respectively, the lower recovery value being due to the lower selectivity of rhodamine B or lesser stability of the insecticide. Both methods were found to be satisfactory. Polarography, however, permitted determination of lower pesticide concentrations, provided reproducibility and accuracy over a wide range of concentrations, and gave more unequivocal results. A more specific developer should be sought which would not interfere in polarography of the active functional group of the substance under examination.

76-0817. Talbott, T. D.; Van Blarcum, C. L.; Evans, R. T.* (Chemagro Agric. Div., Mobay Chem. Corp., Kansas City, MO 64120). **Semiautomated determination of di-syston in granular formulations.** *J. Agric. Food Chem.* 24(1): 155-160; 1976. (4 references)

The semiautomated determination of Di-Syston, *O,O*-diethyl *S*-[2-(ethylthio)ethyl] phosphorodithioate, in granular clay formulations has been made more specific. Interference from naturally occurring phosphorus in the clay carrier, a source of difficulty in the previously reported method, is eliminated, and the direct determination of Di-Syston disulfoton in the presence of Dasanit, *O,O*-diethyl *O*-[4-(methylsulfinyl)phenyl] phosphorothioate (fensulfothion), is now possible. The new method is essentially equivalent to the previous one with respect to precision and manpower requirement. The procedure involves prewetting the granular samples with water containing a small amount of surfactant, extracting the Di-Syston with 2-methoxyethanol–water (10:1), hydrolyzing the Di-Syston to ethylthioethylthiol, and

measuring the hydrolysis product colorimetrically after allowing it to react with a sulfhydryl reagent, 5,5'-dithiobis(2- nitrobenzoic acid) (DTNB). (Author abstract by permission)

76-0818. Gilbert, M. D.; Maylin, G. A.; Lisk, D. J.* (Pestic. Residue Lab., Dep. Food Sci., N.Y. State Coll. Agric. and Life Sci., Cornell Univ., Ithaca, N.Y. 14853). **Chromatographic analysis of neodecanoic acids in onions.** *J. Agric. Food Chem.* 24(1): 194-195; 1976. (9 references)

A method is described for determining residues of the desiccant, neodecanoic acid (NDA), in onion bulbs. Following isolation by selective methylation and removal of plant acids, NDA is converted to the pentafluorobenzyl derivative and determined by electron affinity gas chromatography. The method is capable of detecting about 0.08 ppm of NDA and has been applied to analysis of field samples. (Author abstract by permission)

76-0819. Caswell, R. L. (Criteria Evaluation Div., Off. Pestic. Programs, Environ. Protect. Agency, Washington, DC 20460). **Report of pesticide formulations I.** *J. Assoc. Off. Anal. Chem.* 58(2): 190-192; 1975.

The group of Associate Referee topics under the General Referee on Pesticide Formulations has been divided into two sections: the first includes organophosphates, carbamates, herbicides, plant growth regulators, and the physical properties of pesticides; and the second includes chlorinated insecticides and metallic and elemental determinations. Associate referees were appointed for benomyl, dioxathion, fluometuron, leptophos, methyl parathion, methyl parathion (encapsulated), plant growth regulators, rodenticides, and folpet. Representatives from eleven countries, AOAC, the Food and Agriculture Organization, and the World Health Organization attended the eighteenth meeting of the Collaborative International Pesticide Analytical Council (CIPAC) in London. Pesticides were allotted to the various countries for study and papers were presented on new methods of pesticide analysis. Methods for the analysis of the following pesticide formulations were presented: benomyl, carbaryl, chlorophenoxy herbicides, ethion, malathion, methyl parathion (encapsulated), naled, phosphamidon, picloram, thiolcarbamate herbicides, and *s*-triazine herbicides.

76-0820. Bontoyan, W. R. (Off. Pestic. Programs, Environ. Protect. Agency, Beltsville, MD 20705). **Report on pesticide formulations II.** *J. Assoc. Off. Anal. Chem.* 58(2): 193-194; 1975.

Associate Referees were appointed for atomic absorption spectroscopy, bromoxynil, endosulfan, endrin, and PCNB. As reported at the CIPAC Symposium in June 1974, carbaryl, coumaphos, diazinon, malathion, methyl parathion, parathion, phenoxy acid and ester herbicide, picloram, and warfarin have been successfully analyzed by high-pressure liquid chromatography. The results obtained with this method compare favorably with those obtained by other methods. Status reports were presented regarding the development of analytical methods for atomic absorption spectroscopy, alachlor and propachlor, captan and folpet, chlorobenzilate and chloropropylate, contaminants in pesticide formulations, dicofol, dinocap, mercurials, methoxychlor, *N*-octyl-bicycloheptene-dicarboximide, PCNB, pyrethrins and allethrin, and rotenone and other rotenoids. Recommendations of the General Referee are reported

76-0821. Kawano, Y.; Audino, J.; Edlund, M. (Dep. Agric. Biochem., Univ. Hawaii, Honolulu, HI 96822). **Analysis of paraquat formulations by liquid chromatography.** *J. Chromatogr.* 115(1): 289-292; 1975. (20 references)

Results are presented of a liquid chromatography study using an ultraviolet detector for the analysis of paraquat formulations. Analyses were run for paraquat in commercial formulations determined by both liquid chromatography and colorimetry. The linear range of paraquat dichloride, using the liquid chromatography instrument range setting of 1.0, was 10-35 μg; minimum detectability was 100 ng with an instrument setting of 0.02. The manufacturer's label for the commercial formulation indicated a paraquat dichloride content of 29.1%. The mean analytical value of 25 determinations by liquid chromatography was 29.5%. The mean analytical value for a similar number of determinations obtained by the official colorimetric procedure was 30.5% Although the coefficient of variation was slightly higher for the liquid chromatograph data compared to that for the colorimetric data, the liquid chromatography method suggested a more reliable procedure for the acquisition of consistent and uniform results. This procedure is also less tedious and less time-consuming than colorimetry.

76-0822. Burgett, C. A.; Green, L. (Hewlett-Packard, Avondale, PA 19311). **Improved flame photometric detection without solvent flameout.** *J. Chromatogr. Sci.* 12(6): 356-359; 1974. (11 references)

A simple modification in the flame photometric detector is reported. The hydrogen gas and air oxygen gas inlets were reversed to form an oxygen- hyperventilated flame. This resulted in the maintenance of efficient combustion of the hydrocarbon solvent and, by maintaining a hydrogen-rich system, still allowed chemiluminescence of sulfur and phosphorus moieties in the sample. With the new configuration, no solvent flameout was encountered even with 50 μl injections. The signal-to-noise ratio was also increased, with improvement of the baseline stability of the detector, dynamic working range, and linearity. The selectivity of the FPD for both phosphorus and sulfur compounds was identical in both the new and older configurations. The modification allows for the automatic analysis of pesticide extracts without the use of flame auto-ignitors.

76-0823. Leuck, D. B.; Jones, R. L.; Bowman, M. C. (South. Grain Insects Res. Lab., Tifton, GA 31794). **Chlorpyrifos-methyl insecticide residues: their analysis and persistence in coastal bermudagrass and forage corn.** *J. Econ. Entomol.* 68(3): 287-290; 1975. (10 references)

Residues of chlorpyrifos-methyl [*O,O*-dimethyl *O*-(3,5,6- trichloro-2-pyridyl) phosphorothioate], its *O*-analogue and pyridinol hydrolysis product were determined in Coastal bermudagrass, *Cynodon dactylon* (L.) Pers., and corn. The insecticide was applied in the field as aqueous sprays of an emulsifiable concentrate at rates of 0.5, 1.0, and 2.0 lb AI/acre. Residues of the parent compound and its *O*-analogue were analyzed by gas chromatography, using a flame photometric detector sensitive to phosphorus; the pyridinol was analyzed as the trimethylsilyl derivative by using electron-capture gas chromatography. Total residues in corn and grass treated at all levels declined to less than 1 ppm (mostly pyridinol) during 21 and 28 days of weathering in the field. Residues of the parent compound diminished rapidly; no trace (< 0.01 ppm) of the *O*-analogue was detected. (Author abstract by permission)

76-0824. Lakshminarayana, V.; Menon, P. K. (Cent. Plant Protect. Training Inst., Hyderabad, India). **Clean-up of cereal and milk for determination of residues of organochlorine insecticides.** *J. Food Sci. Technol (Mysore)* 12(3): 144-146; 1975. (12 references)

To facilitate the screening of foodstuffs for organochlorine residues, a simple clean-up method for cereal and milk samples has been devised. Cereals are extracted with hexane and acetone (3:1) and milk is shaken with saturated sodium oxalate followed successively by ethyl alcohol, ethyl ether, and petroleum ether. The insecticides in the milk extract are then partitioned to acetonitrile saturated with petroleum ether. The cleanup of the cereal and milk extracts is done by thin-layer chromatography over a 500 micron thick alumina plate, using acetonitrile as the developing solvent. The extract equivalent to 5 g of the sample is reduced to 0.5 ml and spotted on the plate, after which the alumina is extracted with acetone and the cleaned extract is spotted on a silica gel-silver nitrate thin-layer plate. The plate is developed in cyclohexane and then exposed to UV light (250 μm) for 10 min. The smallest amount of pesticide which can be detected is 0.1 μg of DDT, endrin, and lindane, and 2 μg of BHC. Recovery of these pesticides from Jowar, rice, and wheat ranged from 80 to 95%.

76-0825. Chakraborti, J.; Mukherjee, G.; Mukherjee, A. K.; Roy, B. R. (Cent. Food Lab., Calcutta, India). **Estimation of dimethoate in foods.** *J. Food Sci. Technol. (Mysore)* 12(3): 146-148; 1975. (15 references)

A method is reported for the qualitative detection and quantitative estimation of dimethoate pesticide residues on foodstuffs (vegetables and cereals). The sample is extracted with benzene and filtered, and the solvent in the filtrate is evaporated on a water bath. Acetone is then added before spotting on thin-layer chromatographic plates coated with silica gel G. The mobile solvent is benzene and acetone (9:1) and the chromogenic agent is 0.5% palladium chloride in 8% HCl. The resulting spots are scraped from the plates and added to *N,N*-dimethyl- formamide, shaken, centrifuged, and the optical densities of the resulting clear supernatant liquid solutions are measured in a spectrophotometer at 435 nm.

76-0826. Aleksandrova, L. G. (Kiev Sci. Res. Inst. Ind. Hyg. Occup. Dis., Kiev, USSR). **Opredelenie ronita v voda, vozdukhe, rasteniyakh i biologicheskikh ob'ektakh. [Determination of ro-neet in water, air, plants, and biological materials.]** *Khim. Sel'sk. Khoz.* 13(9): 59-60; 1975. (3 references) (Russian)

Thin-layer chromatographic, UV-spectrophotometric, and colorimetric methods are described for determination of ro-neet (cycloate) in air, water, plants, and biological materials. Ro-neet is extracted with diethyl ether from plant materials, from air sampling filters, from water and urine, and with a combination of sodium citrate and diethyl ether from blood. Petroleum ether is used for extraction from organs. For thin-layer chromatographic determination, the extract is concentrated and applied on alumina layer, using a 4:2:1 ratio of hexane-benzene-chloroform as a mobile system for tissues, a 2:1 ratio of heptane-acetone, a 3:2 or 4:1 ratio of benzene-hexane for air, a 3:2 ratio of benzene-hexane for water and blood, and a 1:1 or 1:3 ratio of benzene-hexane for urine. A heptane-acetone mixture (1:1), and then benzene are used for plant extracts. A reagent composed of bismuth nitrate, potassium iodide, and sulfuric acid is used for visualization. The minimum detectable quantity is 10 μg. The sensitivity is 4 mg/kg in plant materials, 20 mg/kg in organs, 1 mg/l in urine, 0.05 mg/l in water, and 1 mg/m^3 in air. The recovery rates are 83-85% from plant materials, 88-92% from biological materials, and 90-95% from water and air. Another UV-spectrophotometric method, having a sensitivity of 10 μg, is based upon the measurement of the optic density at 232 nm. A colorimetric method is based upon the acid hydrolysis of ro-neet to secondary amines with subsequent complex formation with copper dithiocarbamate. The sensitivity is 10 μg.

76-0827. Ramotsane Solyom, J. (Natl. Inst. Vet. Hyg., Hungary). **DDT es gamma-HCH vekonyreteg-kromatografias meghatarozasa mergezett mehekbol. [Thin layer chromatography for detecting DDT and gamma-BHC in poisoned honey bees.]** *Magy. Allator. Lapja* 29(7): 489-492; 1974. (15 references) (Hungarian)

Thin-layer chromatographic methods are described for the detection and determination of DDT and lindane in poisoned honey bees, and the effect of storage time and the duration of the extraction (24 or 168 hr) on the residue levels. Following extraction from the dead bees

with petroleum ether, the extract is cleaned up on a column chromatograph, after which DDT and lindane are determined on alumina layer using *n*-hexane as solvent, and 2-phenoxyethanol with silver nitrate for visualization. When analysis was started immediately after the death of the bees, and an extraction time of 24 hr was applied, 2 ppm of DDT was found, against 2.8 ppm after 168 hr extraction, when 0.2 ppm of DDE was also found. When the analysis was started 72 hr after death, the DDT and DDE contents were 1.6 and 0.24 ppm in case of 24-hr-extraction, and 2.4 ppm and 0.24 ppm after 168-hr-extraction. When the analysis was started 168 hr after death, the DDT and DDE concentrations were 1.6 and 0.8 ppm after 168-hr-extraction. The lindane residue was very low at 0.02 ppm when analysis was started immediately after death, and an extraction time of 24 hr was applied, against 0.4 ppm after extraction for 168 hr. The lindane concentrations were highest when analysis was begun immediately or within 72 hr after death, and an extraction time of 168 hr was used. No lindane was detected when 168-hr-extraction was started 168 hr after death.

76-0828. Bajer-Rapic, B.; Schmid, E. R.; Juenger, E.; Pollak, K. (Anal. Inst. Univ. Wien, Vienna, Austria). **Duennschichtchromatographische Trennung und enzymatischer Nachweis von Carbamatpestiziden in Pflanzenextrakten. [Thin-layer chromatographic separation and enzymatic detection of carbamate pesticides in plant extracts.]** *Nahrung* 19(7): 551-555; 1975. (8 references) (German)

A new thin-layer chromatographic technique is described for the separation of carbamate pesticides from plant material (apples, pears, onions, carrots, spinach), as is an enzymatic method for their detection. The cellulose plates were impregnated with polar substances (ethylene glycol, triethylene glycol, and β,β'-oxydipropionitrile). The solvents used were *n*-heptane/chloroform and iso-octane dioxane. No preliminary clean-up was necessary. The slight cholinesterase-inhibiting effect of the plant extract interfered with the detection of pesticides with very high *Rf* values (between 0.9 and 1), e.g., of chlorpropham, and the coloration interfered with the detection of pesticides in carrot and spinach extracts. Nevertheless, it was possible to separate and detect methomyl, carbaryl, propoxur, and aldicarb. The *Rf* values of these carbamates were not influenced by the kind of plant material in the case of apples, pears, and onions, nor by the quantity of plant material in the 50-200 mg range.

76-0829. Scott, T. W.; Chu, K. C.; Venugopalan, M. (Physico-Chem. Lab., Western Illinois Univ., Macomb, IL 61455). **ESR studies of cigarette tobacco, smoke, and ashes.** *Naturwissenschaften* 62: 532-533; 1975. (6 references)

The electron spin resonance (ESR) spectra of cigarette smoke, tobacco, and ashes were investigated using samples of tobacco from popular brands of cigarettes. The tobacco ash showed a six-line spectrum of manganese with a g value of 2.0073 and a splitting constant of 99.6 Gauss, as well as a singlet corresponding to that for an unidentified radical with a g value of 2.0023; the latter value was close to that usually observed for free electrons. With increasing microwave power, a saturation effect was not observed. In the cigarette smoke, only the six-line spectrum of manganese was observed, indicating that any free radicals present were short-lived; $Mn_2(CO)_{10}$ was not present. Samples of tobacco yielded ESR spectra similar to those for the ashes, but the peaks were much less resolved. Water extracted about 16 mg of Mn per kg of tobacco, the extracted amount representing about 10-15% of the Mn in the tobacco. Apparently all the manganese found in tobacco is not of plant origin; a significant amount (10-15%) is contributed by the chemicals used in dusting tobacco plants.

76-0830. Ott, D. E. (Dep. Entomol., Univ. California, Riverside, CA 92502). **Automation in the pesticide analytical laboratory.** *Residue Rev.* 55: 1-90; 1975. (283 references)

Since the introduction of an AutoAnalyzer method for the enzymatic determination of cholinesterase-inhibiting pesticides in 1960, many other automated analytical systems or related mechanized analytical aids for individual and/or groups of pesticides have evolved and are reviewed. They include several automated end determinative systems (colorimetric, fluorescent, and UV detection), a few systems which have been developed for mechanical processing and cleanup, and a continuous automated system for biphenyl residues in citrus fruit rind which did everything automatically, including cleanup, down to UV detector recorded output after the manual weighing of chopped citrus fruit rind into sampling cups. The development of a method for certain triazine residues in soil was also reviewed which, in its final version, depended upon automation in a discontinuous manner, with two off-line manual operations, for an almost totally automated method after manual weighing of sieved soil samples into sample cups. The end determination was by means of an automated gas chromatograph with digital integrator connected to a tape punch. The punched tape output was then fed off-line through a tape reader to a programmable desktop calculator connected to an automatic electric typewriter for producing data report sheet copy. Advances in automation in polarography, thin-layer chromatography, liquid chromatography, gas chromatography, combined gas chromatography/mass spectrometry, atomic absorption spectrometry, atomic fluorescence spectrometry, infrared spectrometry, X-ray spectrometry, and computer data handling systems have also been reviewed and discussed here with emphasis placed upon areas of application and/or of potential application in the pesticide analytical laboratory. Some automated analytical methods are now being recognized by certain "official" agencies as herein discussed.

76-0831. Van Dyk, L. P.; Visweswariah, K. (Plant Protect. Res. Inst., Private Bag, Pretoria, South Africa). **Pesticides in air: sampling methods.** *Residue Rev.* 55: 91-134; 1975. (129 references)

Sampling methods used to collect both aerosol and vapor-phase pesticides are reviewed. Shortcomings and advantages of individual techniques and combined systems are discussed. Experimental design, sample size, rate and duration of sampling, and the limitations imposed on the method by the collecting and analytical techniques are also reviewed. Specialized sampling techniques used for specific purposes are included. (Author abstract by permission)

76-0832. Magallona, E. D. (Dep. Entomol., Coll. Agric., Univ. Philippines, Los Banos, College, Laguna, Philippines). **Gas chromatographic determination of residues of insecticidal carbamates.** *Residue Rev.* 56: 1-77; 1975. (222 references)

Gas chromatography as it is known today is more than just a series of operations that eventually results in a chromatogram. Preanalysis manipulations are recognized as important operations. The transformations of pesticides in the environment and possible chromatographic interferences from the myriad of synthetic organic chemicals in the environment make identity confirmation an added burden. Extraction is the area where more work needs to be done. Fortification studies give an acceptable index of pesticide recovery for cleanup, but extraction does not. Chlorinated, water immiscible solvents are used for carbamate residue extraction, but are generally inefficient with organochlorines and organophosphates. There is a need to study the efficiency of several extraction procedures. Some procedures used for cleanup are coagulation, solvent partitioning, and chromatography. The use of column chromatographic cleanup to separate carbamate mixtures should be explored. Derivative formation to overcome the thermal instability of aryl *N*-methylcarbamates offers distinct advantages in most cases over detection of the carbamate itself. In some cases, derivatization may present more problems than it solves. Phenol derivatization is most advantageous: more specific than amine derivatization, not as volatile as methylamine, and no evaporative losses at room temperature. The electron-capture detector is most commonly used for derivative detection but specific detectors are also applicable in a majority of cases. The trichloroacetyl derivative could be detected with the microcoulometric detector and the 2,4-dinitrophenyl ether derivative could also be analyzed with nitrogen detectors. Lowered minimum detectability limits and greater specificity for nitrogen make the electrical conductivity detector very promising for carbamate residue analysis. Confirmation of chromatographic peaks is not as critical for the relatively less persistent carbamates as for DDT and other persistent organochlorines. Carbamates undergo a variety of transformations in the environment and substrates; toxicity and environmental effects also vary. Determination of the metabolites, especially toxic compounds, and their accurate quantification is essential. Since derivatization is the basis for quantitation, substrate extractives or other contaminants could be derivatized and mistaken for the carbamate or its metabolites. IR, MS, and NMR data for carbamates are very useful for confirmation. Derivative data would enhance the use of these spectroscopic techniques for carbamate confirmation. (Author abstract by permission, abridged)

76-0833. Khan, S. U. (Chem. Biol. Res. Inst., Res. Branch, Agric. Can., Ottawa, Ontario, Canada). **Chemical derivatization of herbicide residues for gas liquid chromatographic analysis.** *Residue Rev.* 59: 21-50; 1975. (157 references)

A review is presented of derivatization methods which are used to convert herbicides and their metabolites to more volatile, sensitive, and stable compounds prior to GLC analysis. The derivatization reactions included methylation, halogenation, nitration, hydrolysis followed by further derivatization, chemical reduction, silylation, and pyrolysis. The residues of widely used chlorophenoxy acids, the chlorobenzoic acids, and the halogenated and nitrophenolic herbicides can be methylated with diazomethane, BF_3-methanol, or dimethyl sulfate, and detected at ppm or ppb levels. Herbicides containing only one chlorine atom, such as MCPP, are not detected by electron capture GLC at residue levels. Halogenation or nitration reactions are utilized to derivatize such herbicides, thus increasing their response to electron affinity detection. Alkylation of *s*-triazines and their hydroxy analogs with sodium hydride/methyl iodide/dimethyl sulfoxide is a useful technique for identity confirmation at ppm levels, but sensitivity and reproducibility are not satisfactory for quantitative determination. The phenyl-substituted urea and carbamate herbicides show a relatively poor response to direct electron capture GLC since they frequently undergo thermal decomposition. By acid hydrolysis and bromination, these compounds are converted to sensitive brominated aniline derivatives. As little as 0.2 ng of the equivalent herbicides can be detected. Caution is urged in the interpretation of results since the same brominated derivatives may be obtained from other herbicides. Formation of brominated derivatives by coextractives is another disadvantage. Complicated gas chromatograms that are difficult to interpret often result because of this. Chemical reduction is very useful to convert bipyridylium herbicide residues to nonionic derivatives suitable for GLC analysis. Application of silylation to the GLC analysis of herbicide residues is a recent development. Though the technique is adequate for confirmatory tests of *s*-triazine residues, it is not recommended for use with an alkali flame ionization detector. The silylated derivatives lower the detector sensitivity greatly.

76-0834. Mallet, V. N.; Belliveau, P. E.; Frei, R. W. (Dep. Chem., Univ. Moncton, Moncton, New Brunswick,

Canada). **In situ fluorescence spectroscopy of pesticides and other organic pollutants.** *Residue Rev.* 59: 51-90; 1975. (104 references)

Some of the most recent applications of TLC and in situ fluorescence spectroscopy to the determination of pesticides and other organic pollutants have been described. The technique is a powerful tool for the qualitative and quantitative determination of minute quantities of organic compounds. The fluorogenic methods lie between enzymatic and chromogenic detection techniques in terms of sensitivity. Justification for the use of fluorogenic reagents for the detection of pesticides on thin-layer chromatograms stems mainly from the fact that the fluorescence can be quantitated with a high degree of precision, i.e., around 2% relative error for 1-μg spots. Reproducibility was shown to decrease considerably at lower concentrations. In situ fluorescence spectroscopy compares favorably with gas chromatography in terms of quantitative capability. The detection limits obtained by direct fluorometry on TLC of organothiophosphorus pesticides such as Guthion, which are strongly retained by the column. Since TLC is also useful as a cleanup technique, preliminary cleanup, as is often the case with gas chromatography, is rarely necessary except in the case of complex biological samples. This results in time saving. Another important advantage is the low cost of equipment and operation. The methods described offer a reasonable alternative to gas chromatography for the determination of pesticide residues and may serve to check gas chromatographic data. (Author abstract by permission)

76-0835. Barbina Taccheo, M.; Del Zan, F.; Deluisa, A. (Cent. Reg. Sper. Agrar., Fruili-Ven., Guilia, Udine, Italy). **Prove per la determinazione di residui di benomyl in campioni di vini con un metodo colorimetrico ed uno microbiologico. [Trial determination of benomyl residues in wine samples by a colorimetric and microbiological method.]** *Riv. Viticolt. Enol.* 26(2): 63-67; 1973. (8 references) (Italian)

White pinot wine samples were taken from grapes treated 4 times with benomyl in May, June, and August, 1972 and harvested in September, 1972. Analytical procedures were also applied to a control group. Following extraction of the benomyl residue, a standard curve was made on the basis of a solution with a known concentration of benomyl in ethyl acetate. Extraction proceeded as with the wine sample. The final extract of bromide was diluted at various concentrations and analyzed in the colorimeter. The absorbance of the final product of the degraded benomyl, 2-aminobenzimidazole, was read at 445 nm, using the ethyl acetate as a reference check. The residue found was 0.6 ppm, low as compared to the tolerance limits for residues of benomyl-based fungicides, 3 ppm in the case of carbendazim (BCM). A more efficient microbiological "bioautograph" method has been perfected. Benomyl and BCM are extracted in chloroform, placed on a silica slab, and developed in acetone. Following a 48 hr incubation period in a damp room at 20°C, growth of fungus is inhibited where benomyl is present. This is visible as clear spots surrounded by the greenish growth of penicillium, used as a detecting medium. In preliminary studies, the range of benomyl was 0.01 to 0.05 μg.

76-0836. Toda, K.; Fujiwara, M. (Kyoto Municip. Res. Inst. Hyg., Kyoto, Japan). **[Determination of residual amounts of carbaryl and hydrol (4-diallylamino- 2,5-dimethyl *N*-methylcarbamate) with FTD-gas chromatography.]** *Shjokuhim Eiseigaku Zasshi (J. Food Hyg. Soc. Jpn.)* 16(6): 417-419; 1975. (Japanese)

Methods of determining residual amounts of carbaryl and hydrol (Allyxycarb, 4-diallylamino-3,5-dimethylphenyl *N*-methylcarbamate) were examined by direct analysis using FTD-gas chromatography. Mutual separation and determination of carbaryl, hydrol, 2-chlorophenyl *N*- methylcarbamate and 2-*sec*-butylphenyl *N*-methylcarbamate were successful under the following conditions: 2 m column of 1.5% SE-30 (DMCS) at a constant temperature of 160°C for 3 min, then raised to 220°C at the rate of 30°C/min, remaining constant for 8 min. The minimum detectable amounts were, respectively, 20-40 and 10-20 ng for carbaryl and hydrol. Recovery of carbaryl and hydrol from fortified apples at 1 ppm was 99 and 91%, respectively, with a minimum detectable concentration of 0.04 and 0.02 ppm with no observable interfering peak.

76-0837. Yoshihara, T.; Toyama, I.; Okumoto, C.; Terashima, K.; Nagashima, M. (Dep. Phys. Chem. Res., Tokyo Metrop. Res. Lab. Public Health, Tokyo, Japan). **[Analytical method for carbamates in termiticides.]** *Tokyo Eisei Kenkyusho Nempo (Annu. Rep. Tokyo Metrop. Res. Lab., Public Health)* 26(1): 106-109; 1975. (10 references) (Japanese)

A method of determining *N*-methylcarbamates contained in commercial termiticides is reported. This procedure was developed because conventional methods are subject to occasional interference by substances such as chlorophenols. The method employs a cleanup by column chromatography using alumina for removing interfering ingredients and a pretreatment of trifluoroacetylation of *N*-methylcarbamate for gas chromatographic analysis. Recovery of 2-isopropoxyphenyl *N*-methyl carbamate from a commercial specimen was 96.2% by this method, and variation was minimized by reacting the carbamate with trifluoroacetic acid anhydride in pyridine for 4 hr at room temperature. The minimum detectable amounts of trifluoroacetyl carbamates by gas chromatography with FID were 0.18, 0.16, and 0.34 μg, respectively, for 3-methylphenyl *N*-methylcarbamate; 3,5-dimethylphenyl *N*-methylcarbamate; and 2-isopropoxyphenyl *N*- methylcarbamate.

76-0838. Metelev, V. V.; Brichko, V. F. (All-Union Sci. Res. Inst. Vet. Hyg., USSR). **Opredelenie yalana i prop-**

anida v vode i rybe. [Determination of yalan and propanil in water and fish.] *Veterinariya (Moscow)* 9: 106-108; 1975. (Russian)

Gas-chromatographic methods for the determination of yalan (Molinate) and propanil in water and fish are presented, and results of residue analyses in water and fish samples artificially contaminated with these pesticides are reported. Yalan is extracted from fish by means of ethyl or butyl ether at a rate of 72.8%, and 75.9% extraction is possible from water by means of ethylacetate of hexane. Gas-chromatographic determination is done with thermionic detector. The sensitivity amounts to 0.005 mg/kg in fish, and to 0.001 mg/kg in water. Propanil is extracted by means of ethylacetate at a rate of 80.6% from fish and 93% from water. The sensitivity amounts to 0.001 mg/kg or 0.001 mg/l. Yalan (10 mg/l) and propanil (5 mg/l) were found to be highly toxic for fish. Yalan was localized in the gills and skin in concentrations of 1.42-1.75 mg/kg, without having cumulative properties. Propanil accumulated in the parenchymatous organs (brain, spleen, liver, kidneys) in concentrations of 4.5-8.8 mg/kg. Fish is fit for consumption 30 days after the rice field is treated with yalan, and 15 days after propanil treatment. Rice fields treated with these pesticides are recommended for use for fish breeding. Yalan was found to hydrolyze in water within 30-40 days, and propanil within 16-17 days. Propanil is hydrolyzed to 3,4-DCA which is decomposed within 9-10 days.

76-0839. Clauss, B.; Acker, L. (Inst. Lebensmittelchem., Westfael. Wilhelms-Univ., Muenster, Germany). **Zur Kontamination von Milch und Milcherzeugnissen mit chlorierten Kohlenwasserstoffen im westfaelischen Raum. I. Methodik. [On the contamination of milk and milk products with chlorinated hydrocarbons in Westfalia. I. Methods.]** *Z. Lebensm.-Unters.-Forsch.* 159(2): 79-84; 1975. (German)

A complex method for organochlorine pesticide residue analysis in milk and milk products in Westfalia is described. After the addition of sodium oxalate, fat content is extracted with ethanol, diethylether, and petroleum ether. The extract is then taken in in petroleum ether and cleaned up with celite, using propylene carbonate for elution. The eluate is further purified on another column containing florisil and alumina, using cyclohexane for elution. Gas chromatograph with 63Ni electron capture detector, and argon with 5% methane were used for the analysis. Yields between 82 and 100% could be obtained for all substances except for β-BCH. It was possible to separate hexachlorobenzene, α-BHC, lindane, heptachlor epoxide, *p,p'*-DDE, dieldrin, *o,p'*-DDT, *p,p'*- DDD, and *p,p'*-DDT. The yields were 82% for hexachlorobenzene, 100% for α-BHC and lindane, 15-20% for β-BHC, 101% for heptachlor epoxide, 102% for *p,p'*-DDE, 99.5% for *o,p'*-DDT, 92% for dieldrin, 99% for *p,p'*-DDD, and 102% for *p,p'*-DDT. Aldrin and heptachlor could not be detected due to their metabolization to dieldrin and heptachlor epoxide, respectively. The *o,p'*-DDT concentrations were below the detection limit of 3 ppb. The readings of the electron capture detector were practically linear in a range of 10-100 pg.

See also **76-0674**

PESTICIDES ABSTRACTS

QUARTERLY INDEX

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PREFACE

The basic design for this index was supplied by the Technical Services Division, Office of Pesticide Programs, Environmental Protection Agency. It consists of two subject indexes (concept and compound) and two author indexes (personal and corporate). Primary and secondary headings in the Concept Index appear as subordinate headings in the Compound Index, both indexes having three levels of specificity.

In the Concept Index, only general aspects are indexed under the broader terms shown below. For specific terms, the reader should consult the appropriate heading in the Concept Index, selecting the narrower term that best fits his need.

Compounds are indexed by their common names; where other compound designations are used by authors, these synonyms appear with the notation to *see* the common name. Articles referring, in general, to structural or functional chemical classes are indexed under the broader headings (e.g., organochlorines, herbicides, etc.).

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